THE

MECHANICS' MAGAZINE,

MUSEUM,

Register, Journal,

AND

GAZETTE,

JANUARY 6TH — JUNE 30TH, 1849.

EDITED BY J. C. ROBERTSON.

VOL. L.

"To present, as it were, in several columns what is extant and already found—and what is defective and further to be provided."—BACON.

London:

ROBERTSON AND CO.,

MECHANICS' MAGAZINE OFFICES,

No. 166, FLEET-STREET, LONDON; AND No. 99B, NEW-STREET, BIRMINGHAM.

AGENTS :—FOR MANCHESTER, MESSRS. WISE AND WOOD,
3, COOPER-STREET;
EDINBURGH, J. SUTHERLAND;
GLASGOW, W. R. M'PHUN AND DAVID ROBERTSON;
DUBLIN, MACHIN AND CO., 8, D'OLIER STREET;
PARIS, A. & W. GALIGNANI, RUE VIVIENNE;
HAMBURGH, W. CAMPBELL.

1849.

ALPHABETICAL LIST OF NEW PATENTS GRANTED FOR ENGLAND, SCOTLAND, AND IRELAND.

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Brandt	Bearings, railways and carriages	13 April	....	....	382
Brewer & Smith.	Paper and card board	12 Feb.	....	....	166
Brindley	Waterproof paper	28 Feb.	....	....	214
Britten	Cooking, preserving and storing	28 March	....	....	310
Brooke	Lamps	14 March	....	....	262
Brooman	Artificial limbs	27 Jan.	....	....	119
Brooman	Transferring liquids	20 June	....	....	600
Broquette	Printing and dyeing	24 April	20 April	....	406,406
Brown	Measuring liquids and motive power	20 Jan.	12 Feb.	15 May	95 215,503
Brown	Sewing and stitching	8 Feb.	....	....	144
Brown	Rolling and shaping iron	....	13 April	....	406
Browne	Building and rigging vessels ; and railways	6 Feb.	....	....	143
Browne	Looms	29 June	....	....	623
Buckland	Compressing and solidifying fuel, &c.	28 March	....	....	310
Buckler	Boots and shoes	16 Jan.	5 June	....	71,623
Buller	Earthenware	3 May	....	....	431
Burch	Printing	14 June	....	....	575
Burke	Waterproofing, caoutchouc & gutta percha.	26 April	....	....	406
Burton	Pipes, tiles, bricks, &c.	7 June	....	....	549
Calvert	Cleaning and preparing cotton, wool, &c.	18 Jan.	19 June	....	71,623
Campbell	Wheels, ploughs, harrows, steam boilers, and propellers	20 June	....	....	600
Carpenter	Substitutes for buckles.	3 April	....	....	334
Carteron	Dyeing	5 Feb.	27 March	....	143,405
Castley	Varnishes	11 Jan.	....	....	48
Chandois	Orchil	14 Feb.	7 Feb.	....	166,215
Chauffourier	Watches	14 March	....	....	263
Childs	Candles and lamps	13 April	....	....	382
Clark & Motley	Motive power, railroads, resisting strain, supporting pressure, and protecting from fire	14 March	....	....	262
Clarkson	Leather	8 Feb.	....	....	144
Clay	Rolling metals	....	....	14 Feb.	214
Clegg, Henderson and Calvert	Looms	16 April	....	....	382
Cocksey and Nightingale.	Cleaning, bleaching, dyeing, printing and sizeing fabrics	16 April	....	....	382
Cotegrave	Railway signals	22 May	....	....	503
Collins	Paper	....	14 March	....	310
Collins	Preventing injury to health	....	14 June	....	623
Colt	Fire arms	20 June	....	....	600
Crosley	Heating, lighting & drying	28 Feb.	....	....	214
Crosse	Tanning and dyeing	24 May	....	....	503
Cutler	Metal tubes	24 Feb.	....	....	214
Da Costa	Vessels of capacity	12 May	....	....	503
Dalton	Printing	1 May	9 May	....	431,503
David	Bleaching cotton	28 Feb.	....	....	214
Davies	Steam engines	....	9 Feb.	....	215

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Day..........	Weighing machines......	14 Feb.	....	....	166
De Barros	Lasts and gunstocks	14 March	....	....	262
De Bergue....	Steam engines, pumps, and springs.........	23 Jan.	....	....	95
De Chatauvillard.......	Fire arms, cartridges, bullets, bayonets, and ordnance...........	15 May	....	....	478
Deeley........	Ovens and furnaces......	....	24 Jan.	....	214
Defries........	Gas..................	3 March	....	....	238
De la Rue......	Ornamenting surfaces....	....	9 Feb.	....	215
Denison	Pumping engines........	12 June	....	....	575
Dodge......	Spinning, winding, reeling, balling, & spooling	10 May	....	....	453
Donisthorpe	Stopping steam engines ..	12 Feb.	....	....	166
Donisthorpe and Whitehead	Preparing, combing, and heckling............	8 May	....	....	453
Dugdale.......	Hardening articles of iron.	23 Jan.	....	....	71
Dugdale & Birch	Ship building & propelling	31 May	....	....	528
Dunn	Ascertaining and indicating the temperature and pressure of fluids.	....	13 April	....	406
Dunn	Tunnels................	5 June	....	....	549
Dunnington	Looped fabrics..........	3 April	....	....	334
Erwood	Paper hangings..........	15 Feb.	....	....	166
Falconbridge..	Hose pipes and driving bands	26 April	....	....	406
Field..........	Anchors...............	5 June	14 June	....	549,623
Fisher	Coke ovens, heating and lighting.	8 Feb.	....	....	143
Fletcher and Fuller	Turning, boring, planing and cutting.........	28 March	26 March	....	310,405
Fontainemoreau	Covering metallic and non-metallic bodies	14 March	....	....	263
Fontainemoreau.	Weaving..............	2 May	....	....	503
Forlong	Castors................	8 Feb.	....	....	143
Forster......	Ship building and waterproof structures.....	27 June	....	....	623
Francis........	Sawing and cutting wood..	4 Jan.	....	....	23
Galloway......	Steam engines..........	....	21 March	....	310
Garnier........	Orchil................	28 April	21 May	....	406,503
Giblett	Woollen cloth	10 Feb.	....	....	166
Gibson......	Preparing, spinning and weaving machines....	27 Jan.	....	....	119
Godefroy....	Dressing and finishing woven fabrics.......	16 Jan.	....	....	71
Goodfellow.....	Plastic materials.........	24 May.	....	....	503
Goose..	Nails	5 June	....	....	549
Gordon........	Ventilating mines........	19 April	....	....	382
Gougy.......	Raising heavy bodies and fluids	27 Jan.	....	....	119
Gratrix	Finishing woven fabrics...	14 March	12 June	....	262,623
Gray	Water-closets, pumps, cocks, lubricators and deck lights	26 June	....	....	622
Green & Newman	Wheels	28 March	....	5 Jan.	310,120
Green.........	Fuel..................	5 March	....	....	238
Greenhow......	Atmospheric railways....	13 Jan.	....	....	71

INDEX

TO THE FIFTIETH VOLUME.

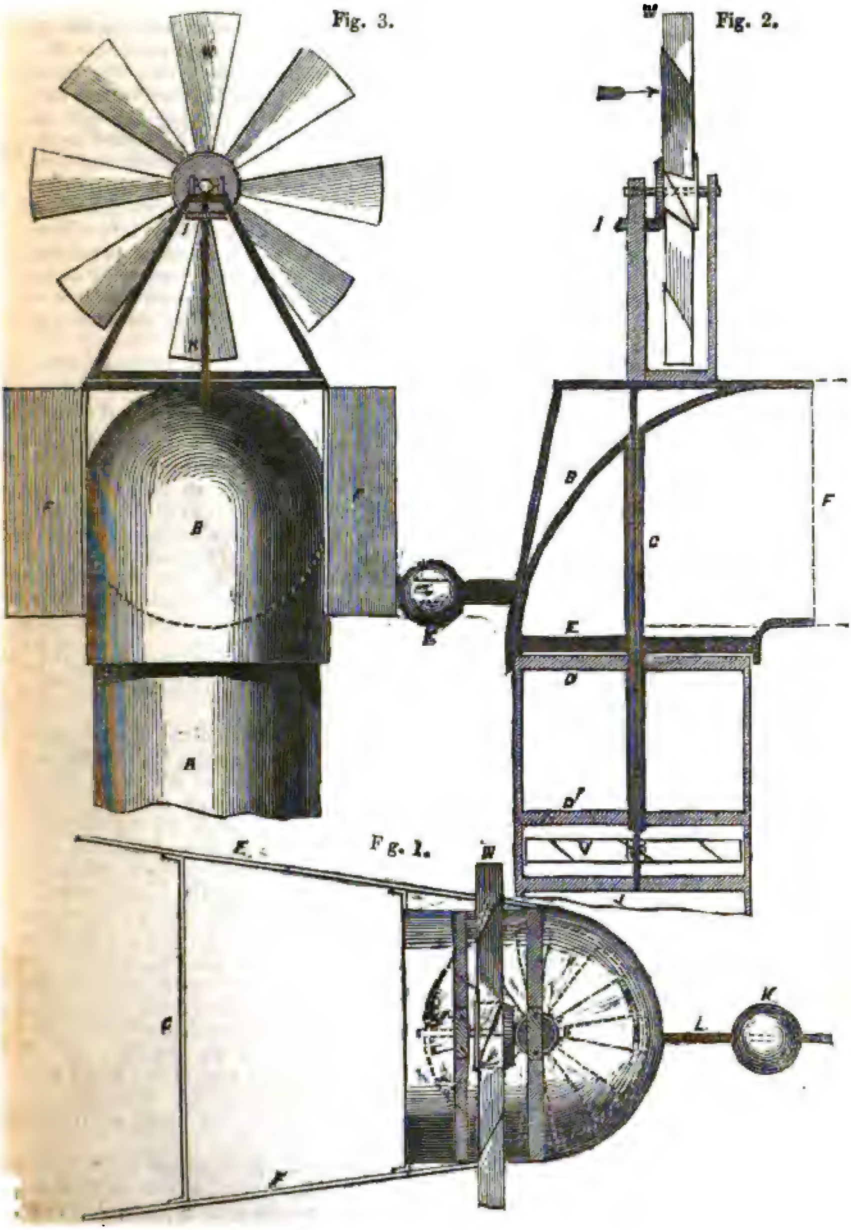
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1326.] SATURDAY, JANUARY 6, 1849, [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

BIRAM'S PATENT VENTILATOR.



DESCRIPTION OF AN APPARATUS FOR VENTILATING SHIPS AND PUBLIC BUILDINGS. BY BENJAMIN BIRAM, ESQ.

Sir,—In last week's Magazine is a description of a method of ventilating ships, by Dr. M'Sweeny. I have long thought it possible to ventilate the holds and cabins of vessels thoroughly, and am persuaded that an apparatus something like what is described in the accompanying paper would accomplish that object. You will perceive that it is one application of the patent which I took out a few years ago.* Under circumstances like that of the unfortunate and melancholy case of the *Londonderry* steamer, there would be wind in abundance to turn the wheel; indeed generally, at sea, there would be sufficient, but in case of a dead calm, the ventilator might be moved by the descent of a weight, or by the action of a spring attached to a proper arrangement of wheels. The contaminated air of a crowded theatre might be very rapidly withdrawn through the roof by the same means. The quantity of air passing through the funnel might be regulated to the greatest nicety by means of a throttle valve within the funnel.

If you think favourably of the plan, I should feel obliged if you will give it a place in the Magazine.

I am, Sir, yours, &c.,

BENJ. BIRAM.

Wentworth, Dec. 30, 1848.

Description.

Fig. 1 is a plan; fig. 2, a side sectional elevation; fig. 3, an end elevation.

A is a funnel prolonged to a considerable height above the roof of the building, or the deck of a vessel. If on a vessel, it should be sufficiently high to allow the hood, B, to revolve freely, clear of mens' heads. C is a hollow vertical shaft, fixed at the inside of the hood, and retained in its place by the stay, E; the bottom end of the shaft is accurately turned to fit into two circular holes in the stays, D, D′, the hood being supported upon D on a collar underneath the stay, E. FF are two thin sheets of iron, or thin boards, retained at their proper distance by one or two iron rods, G, which serve to keep the mouth of the hood from the wind. W is the wind-wheel, fixed in a frame on the top of the hood; when in use, its position is as shown in the drawings, but it may be set at right angles to the position there shown, so that the plates, FF, serve to keep the wind-wheel to the wind, when in use, or from the wind, when not required. Motion is communicated from the wind-wheel by means of bevelled wheels at I, by the shaft, H, passing through the hollow shaft, C, to the horizontal ventilating-wheel, V, placed in the funnel—the lower end of H resting in a thimble in the stay, J. K is a regulating weight, which may be moved backwards or forwards on the lever, L, and is intended to balance the plates, F, on the opposite side of the hood, and also to counteract the force of the wind upon W, so that the flood may revolve more freely.

* February 8, 1842. *Mech. Mag.*, vol. xxxvii., pp. 321, 366, 558.

VENTILATION OF SHIPS AND BUILDINGS.

However efficacious may be Dr. Mac Sweeny's mode of ventilating ships where but few persons are on board, it could hardly suffice where, as in the *Londonderry*, a steerage is crowded with human beings. For due respiration, two gallons of air per minute are required for each individual; for a hundred persons, between five and six thousand hogsheads every twenty-four hours. It cannot be supposed that this quantity could be regularly supplied otherwise than by artificial means.

In 1811, in consequence of a reference to Sir Samuel Bentham, he, in a Minute of the 11th August of that year, made the following, amongst other observations on the subject of the ventilation of ships: "The mode which seems best adapted to answer the purpose effectually is that proposed by Dr. Hales, namely, the extraction of the foul air by means of a machine which he calls a ventilator, which really is a kind of wooden air-pump, but of very simple construction, easy of repair, and requiring little power to work it. Such ventilators were ordered for general use in his Majesty's fleet in or soon after the year 1756; which ventilators, with very little alteration, are now used under the name of White's Extractors.

"On an attentive perusal of Dr. Hale's book on the subject, as well as from my own observations, it appears, however,

that his means, as far as regards the extraction of the foul air, would be found sufficient, if the use of them were persevered in; yet no contrivance has hitherto been introduced, adequate to the easy and regular admission of fresh air to supply the place of that which has been extracted; so that, in some cases, while the foul air has been extracted from one part of a ship, still worse air has been drawn in from other parts."

To supply this deficiency, Sir Samuel added, "It seems desirable that two sets of pipes or trunks should be laid throughout, having apertures opening into every close compartment; one of these sets of pipes being those subservient to the extraction of the foul air, to lead to a fixed ventilator placed at that end of the ship where room can best be spared; the main pipe of the other set of pipes for the conveying fresh air into the several compartments, to be brought up on the quarter-deck or forecastle, where most out of the way, and clear of foul air."

The owners of vessels employed for the conveyance of numbers of steerage passengers on short voyages, cannot be expected to incur much expense in laying such pipes as would afford a sufficiency of fresh air; neither could any of the crew be spared to work an air-pump; yet limiting, in passage vessels, the means of ventilation to such as are cheap and practicable, Dr. Hales's invention may be taken as the ground-work on which to proceed in the contrivance of a suitable apparatus. In the steerage itself of such vessels, there might be fixed a simple and cheap air-pump to extract the foul air, throwing it upwards through a trunk opening above the deck, that trunk carried high enough to prevent the entrance of a sea. The air-pump itself to be worked within the steerage by a winch, or other simple contrivance. It can hardly be conceived but that amongst the passengers many would be found willing to work this pump, were it only for their own comfort, so that no part of the crew need be employed in this service.

For the supply of fresh air another trunk might be brought down from above through the ceiling of the steerage; but as cold air coming in one stream upon the passengers, might be injurious to them, the opening of the trunk might be above a false ceiling, perforated with holes of increased size as they become more distant from the trunk. Thus, the fresh air would be spread equally over the whole steerage.

But it is not only such a calamity as that which befel the *Londonderry*, which calls for ventilation on board passage vessels; for where immediate death does not ensue for want of it, disease is a very frequent consequence—fevers engendered on board, or caught from others, perhaps but slightly ill, often affect passengers after they come ashore.

It might be well worth while, for manufacturers at our seaports, to contrive and fabricate very simple air-pumps of different sizes, so cheap, so easily fixed, and so little inconvenient, that the generality of ship-owners might willingly adopt them. Great nicety of workmanship is not necessary; they might be of wood, or of metal; the valves for the entrance and exit of foul air of course large; and the apparatus not liable to be easily put out of order, or to be damaged by coarse usage—this would be indispensable.

It may be added, that the same mode of ventilation might be advantageously employed in the case of many structures on land, especially those in which crowded assemblies meet. It would have the advantage of being distinct from, and independent of any apparatus for heating, so that while the requisite amount of foul air should be to a certainty withdrawn, the supply of fresh air might either be heated in winter or cooled in summer, as might be thought expedient; and as to expense, the hire of a labourer to work the air-pump would hardly amount to the cost of fuel where ventilation is procured by means of fire, or to the interest of money expended in apparatus for obtaining of a natural draught of air. A crowded church, for instance, might thus have its vitiated atmosphere withdrawn, and be supplied with pure air in lieu of it, at that degree of temperature most suitable for the health and comfort of the congregation.

M. S. B.

THE MARINE DYNAMOMETER.—MR. STEVENSON'S EXPERIMENTS.

Sir,—Within the limits to which science has been applied to the arts, perhaps few instances occur where the want of experimental knowledge is more sen-

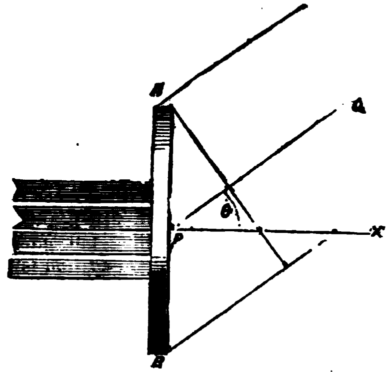
sibly felt, than in that department wherein the results of the marine dynamometer were intended to supply it. And if those results are still found inadequate to fill up that want which every engineer at all connected with marine works must forcibly have felt, it will no doubt be remembered that the course of experiments detailed by Mr. Thomas Stevenson, and inserted at p. 436, vol. xlviii., *Mech. Mag.*, are merely the first trials of an instrument which promises much; and probably only preliminary to more ample and accurate details, which may fairly be expected from the eminent engineer who has taken up the subject.

In a recent article in your Magazine from the pen of your able correspondent, Mr. Dredge (p. 538, vol. xlix.), the author admits the value of the experiments already made, but is apprehensive that an erroneous application of them has been made in practice; and proceeds to a discussion of the subject which appears to me both accurate and original—however, I may doubt its applicability to the point under consideration. Assigning the *mean pressure* upon the spring, he truly shows the work done through a given space by that mean pressure, which is not only *a* convenient expression for expended power, but *the* only means, I believe, known to these countries for estimating all motive force. Yet I apprehend, that were we able to turn the results of the marine dynamometer to any practically useful purpose, that it is not the *mean* but the *maximum* force of the spring that we should deal with, regarding that force as the effect of an impact. If that maximum force can be depended upon as the expression of anything definite, it must be the greatest shock exerted by the sea; and as it is essential, and perhaps sufficient, that the engineer ensure to his building the requisite moment of stability beyond the *greatest* shocks recorded, it would appear unnecessary in this particular case to consider the work done over the space described by the spring.

With regard to the experiments recorded in Mr. Stevenson's paper above referred to, I confess I find many things which appear extremely unsatisfactory. It is clear (p. 437, vol. xlix.) that he holds the same opinion as Mr. Dredge does, that a dynamical force cannot be represented by a statical pressure, and admits the objection to referring the impulsive action of the sea to the pressure of a dead weight. But in the same column he has shown, that by far the greater part of the force exerted upon the spring, must have been derived from the *velocity* of the waves. Now, if the action of the waves of the sea participates of the nature of impact, and that there is an admitted objection to comparing that impact with statical pressure, does not a confusion of effects follow which must go far to deprive the experiments of that value, which alone could be useful to the practical man, when he must recollect that the results were obtained by reference to this admittedly objectionable standard of comparison?

In considering the degree of accuracy which might fairly be attached to these experiments, and the application of the information they unfold to practical purposes, another difficulty presents itself to my mind, arising from the omission of a point of important information in Mr. Stevenson's paper, and which I conceive envelopes the whole subject of these experiments in ambiguity. It is easy to imagine this marine instrument firmly bolted to a wild rock in the sea, and such a hurricane blowing from the westward as occurred upon the 29th March, 1845; the instrument registering upon that occasion a pressure of three tons per square foot. But I apprehend that nothing certain can be inferred from this information without at the same time knowing the *angle at which the axis of the instrument was inclined to the direction of the wind*—a circumstance nowhere alluded to in Mr. Stevenson's account of his experiments. I do not say this essential element was altogether overlooked; nor do I say that had it been so, the Harbour of Refuge Commissioners would not have detected that the truthfulness of the indications of the instrument depended upon this element; but for the purposes of illustration, and in the absence of all reference to the point, I may be permitted to assume that the element was neglected.

Let AB, in the annexed figure, represent the disc of the instrument = one square foot (see p. 436, vol. xlviii.); PX the direction of the axis, and QP the direction of the wind when the instrument registered three tons. Also, let θ be the angle of inclination of the axis to



the wind, and P_1 the pressure which would have been exerted upon the disc, supposing the force to have acted in the direction of the axis:—

Then $P_1 \cos.\theta$ = the diminished force in the direction QP;
And $P_1 \cos.^2\theta = 3$ tons, the force actually registered in the direction of the axis.—$\therefore P_1 = \frac{3 \text{ tons}}{\cos.^2\theta}$ = the force per square foot,

which the instrument would have registered supposing the direction of the wind had coincided with that of the axis; but which direction may have been *inclined to the axis* for anything we know to the contrary.

If we now suppose the direction of the wind during the gale of the 29th March, 1845, to have been inclined to the axis of the instrument at an angle of 45° when the registered pressure amounted to three tons per square foot; then

$$P_1 = \frac{3 \text{ tons}}{\cos.^2 45°} = 6 \text{ tons};$$

so that an unit of surface perpendicular to the direction of the wind would sustain a pressure precisely double that which the same unit would sustain when inclined to that direction at half a right angle, and more or less as the angle of inclination varied.

It appears to me, therefore, that unless this angle of inclination were accurately observed and used in calculating the results of the marine dynamometer, the experiments are of no practical value; and if the exact bearings of the axes of the instruments were observed in each case, and the angle of inclination used in reducing the experiments to their final values, it does appear strange that Mr. Stevenson is silent upon that important point. Very truly yours,

T. SMITH.

Bridgeton, Wexford,
Dec. 28, 1848.

MATHEMATICAL PERIODICALS.

(Continued from page 524, vol. xlix.)

XIII. — *The Mathematician.*

Origin.—This excellent, and in some respects extraordinary periodical, was begun in the eventful year 1745, when the "young Pretender" was heading his gallant Highlanders, and doing battle to gain the crown of his ancestors, and when "Heath" "the half-pay Captain of Invalids" was heading his feeble band of Diarians and *assuming the direction* of the mathematical studies of this country. "His virulence towards Simpson and his friends," is said by Professor Leybourn, "to have exceeded all bounds," and hence the *Mathematician* is supposed to have been begun in order to supply an *antidote* to the malignant *virus* of the editor of the *Diary* and his associates. The most eminent geometer of our country, and whose opinion is *authority* on these subjects, has observed, that "from the *structure* of the volume itself, it would appear that it was only intended to carry it on

for a *limited time* and for a *special purpose*. The announcement in the title page rather expressed the *intention* than the result, and this, too, may account for the 90 questions *given* whilst 200 were *promised*. Besides the work was discontinued on Simpson's being appointed editor of the *Diary*. These observations render the *traditional* opinion extremely probable, and if such were *really* the case, the conductors of the work acted "with great delicacy and temper." Convinced of the probity of their course, and confident of ultimate success, they appear to have rested satisfied, with opposing the simple majesty of truth, to the complicated decrepitude of error. Nor were their expectations disappointed; the *coup de grace* of the "Half-pay Captain" in the prize question for 1753 resulted in his complete annihilation, and the "Marshal's baton" was tranferred to the abler hand of his silently effective and talented opponent. The editors themselves declare that "neither vanity nor interest were the motives to this undertaking, but the *pure love* of *genuine truth*. To evince this, we have chosen *Magna est veritas et prævalebit*, for the motto of our frontispiece: and if in some future numbers our zeal for truth, and indignation to see the public imposed on by paralogisms, should prompt us to criticise upon some late mathematical performances, wherein, if we, or any of our correspondents, should indubitably point out their errors and imperfections, and discover the *true* solutions, we hope the candid world will approve the attempt; and that those precipitate authors who so eagerly rush on to fame will deem it a salutary monition for them (as it will really be intended) to have a more cautious regard for truth, by adhering to the true principles of science, and preserving a just and logical reasoning in their deductions therefrom. In the interim, we recommend to their consideration rash Phaeton's daring attempt and dire disaster, and also this adage, '*ne sutor ultra crepidam*.'" The concluding passages of this extract have been supposed to apply to Mr. Heath and his abettors, and if the preceding hypothesis be correct, the supposition is not improbable. They will, however, equally apply to the author of the *Analyst*, against whose work the *point* of the "Dissertations on Geometry" appears to be directed. The work was discontinued with the sixth number, and forms an octavo volume of VIII + 401 pages.

Editors.—Principal editor, Mr. Edward Rollinson, subsequently editor of the *Ladies' Diary;* and most probably assisted by Simpson and Turner.

With respect to the *real* editorship of this periodical, there is unfortunately nothing but *internal* evidence to guide us. *Tradition* is in favour of Simpson; and this by reason of its being handed down to us through such trustworthy channels as Hutton, Leybourn, and Gregory, becomes of paramount importance, and ought not to be set aside by any minor considerations. Turner, too, has been suspected, but there appears to be fewer reasons for this opinion than the former; for whilst Rollinson and Simpson rarely, if ever, appear as contributors, the name of Turner occurs in the *first* number, and he may be said to have furnished by far the greatest portion of the work. That Simpson was *intimate* with Rollinson is well known, and that he *assisted* Turner in his investigations (as Emerson is said to have assisted Heath) is all but certain: for if we attentively examine the dates of the publication of Simpson's works, we cannot fail to observe that the questions proposed by Turner *about the same periods* have a remarkable similarity to the subjects which would very naturally be most familiar to Simpson's mind. Again; problems 10, 11, 17, 20, 28, 40, 58, and 76, are such as Simpson might be expected to propose, and most probably are all his own, but it is an extraordinary fact, and strongly corroborative of the preceding supposition, that *Turner's* solution to problem 76, is expanded into Section ix., Part 2, of the second edition of *Simpson's Fluxions*, published in 1750. The lemma of the solution is prop. 2 of the work; the *figure* is copied *in toto*, and the notation is identical. It may also be further remarked that in Turner's solution to prob. 88, a reference is made to one of Simpson's papers on the subject of projectiles *previously to its publication* in the *Philosophical Transactions*, which evidently could not have been the case without Simpson's express permission and assistance. "That the *Mathematician* was in a great degree under Simpson's control" is hence appa-

rent, but the following reasons appear to go far to prove that Rollinson was the *real* editor of the work.

1. His name appears in the *Ladies' Diary*, ques. 389, under the signature "R—n," and he also solves prob. 36 in the *Mathematician* under the slightly disguised anagram, "Rosnillon," which had been proposed in the previous number by "R." It is therefore most probable that to Rollinson belong all the questions and solutions under the signature "R."

2. In the solution to prob. 2, p. 92, an allusion is made by "R" to one of Turner's results in such a manner as would only be done by one who had the management of the work.

3. In the solution to prob. 6, p. 96, Turner's solution is *completed*, and two theorems added by "R.," which is what an editor would naturally do.

4. In prob. 8, p. 98, the same "R." includes in his own solution a construction which had been given to the same problem by "Tycho Oxoniensis;" which is what none but an editor would attempt.

5. In accordance with the practice of the times, the method of calculation is given to most of the geometrical questions; where this has not been done, the omission is supplied by "R." as in the solution to prob. 11, p. 102.

6. Where solutions have not been received, the *deficiency* is supplied by "R.," as in prob. 18, p. 111.

7. As the number of correspondents *incre ae*, the signature "R." disappears altogether; as might be expected.

For these reasons, then, the name of Rollinson has been placed *first* on the list of editors, and it remains for those interested in such matters to decide whether they possess sufficient force to set aside the *traditional* evidence previously alluded to; it may, however, be added that the eminent authority before quoted, to whose judgment the preceding has been submitted, declares he "can see nothing which can fairly be urged against it," and anything therefore less than *proof positive* will be insufficient to reverse the arrangement.

Contents.—The first number contains a "Dissertation upon the Origin, Progress, and Improvement of Geometry;" a series of propositions on the parabola; and a collection of problems to be answered in the next number. The succeeding numbers each contain a dissertation, propositions on the conic sections, answers to the problems, and new ones for solution. The first dissertation treats of the progress of geometry among the ancients, and lays down the methods of comparing curvilineal figures as practised by Archimedes and Cavalerius. The second and third dissertations continue the subject, and notice the advances made by Wallis and Barrow. The fourth dissertation contains "a Familiar and Perspicuous Account of the Nature of Fluxions, and the Method of assigning their Relations by Finite Magnitudes." The fifth continues the subject, and the sixth contains "the Application and use of the Method." With regard to the authorship of these dissertations, scarcely a guess can be hazarded. "As far as one can judge from the style, they might be written either by Simpson, Turner or Rollinson, or by neither, or jointly by all," and this appears to be all that can be said on the subject. Whoever the author may be, he seems no mean advocate in Newton's favour, and in concluding his subject he very justly congratulates himself on having shown "what the modern improvements in geometry are; and that they are founded upon the same principles and deduced with the same accuracy, but extended much further than those of the ancients; that they are entirely scientific, and thoroughly freed from any trick or quirk, as has been insinuated by the ingenious author of the *Analyst*." The work also contains 27 propositions on the parabola, 63 on the ellipse, and 59 on the hyperbola; besides an appendix on "the Properties of the Parabola, Ellipse, and Hyperbola, made by cutting a Cone by a Plane." The whole of these were reprinted (with some additions and alterations) from "A Treatise of Conic Sections. Dedicated to the Provost, Fellows, and Scholars of the College of Dublin. By Robert Steell. Dublin, 1723. London: Reprinted for E. Cave, at St. John's Gate, 1745." And though somewhat objectionable on account of the promiscuous use of "the *analytic* and *synthetic* methods," forms, even now, one of the best treatises on the conic sections extant.

Questions. — The total number of questions proposed and answered is 90, though 200 are mentioned in the title-page bearing date 1751. Of these, six

belong to arithmetic and algebra; 10 to the application of algebra to geometry, &c.; four to series, one to chances, four to mechanics and hydrostatics, 17 to plane and spherical trigonometry, three to projectiles, 13 to fluxions, seven to physical astronomy, and 32 to geometrical analysis and construction. Indeed, it might be inferred from the predominance of the geometrical exercises, that the conductors were anxious to promote the study of pure geometry, and though this band of the admirers of the "fine old Grecians" was comparatively small, it no doubt contributed largely to fan the flame which beamed with such refulgent brilliancy in the best days of Lawson, Lowry, Whitley, Butterworth, and Swale. Problem 7 is a neat case of "Tangencies;" problem 14 is a case of trapezium "in which the one diagonal is perpendicular to the line joining the points of intersection of the opposite sides of the quadrilateral." "This property, as given in the *Mathematician*, was known to Ozanam," and has been *generalised* by Professor Davies in question 18 of the *Scientific Receptacle*.* Problem 20 was proposed by Simpson in the *Ladies' Diary* for 1736, but not being satisfactorily solved, was here re-proposed by "T." Problem 32 determines the *minimum* parabola passing through four given points. Problem 40 investigates "the path which a fixed star, by means of the aberration, would appear to describe if the earth revolve in a parabolic or hyperbolic orbit." It was proposed by "T." and answered by Turner only out of *Simpson's Essays*. Problem 46 inscribes a square in a given pentagon geometrically; which has been introduced by Dr. Gregory into "Hutton's Course," and by Mr. Tyson into "Bonnycastle's Mensuration." Problem 57 finds "the equation of that curve which cuts an infinite number of ellipses, similar and concentric, to a given one, at right angles." Problem 58 relates to the "Problem of two Bodies;" it was proposed in the *Ladies' Diary* for 1743, by "Hurlothrumbo" (Simpson), but no satisfactory solution appearing, it was here solved by "Mathematicus," probably Simpson. Problem 66 constructs the triangle when "one side, and the radii of the inscribed and circumscribed circles are given." Problem 76 determines "the gravitation at any point in the produced axis of a given solid, the attraction of each particle being as the nth power of the distance." This problem was proposed by "T." (Simpson?) and the solution given by Turner in the next number is expanded into section ix., part 2, of the second edition of *Simpson's Fluxions*. Problems 88 and 90 relate to projectiles, and prepared the way for Simpson's paper on that subject in the *Phil. Transactions*, which was afterwards re-published in his *Select Exercises* in 1752.

Contributors. — Ashby, B. Oxon, Clark, Farrer, Fratre Euclidis, Grant, Geometricus, Hammond, Hauxley, Hill, Hulme, Kingston, Leigh, Moor, Moss, Mathematicus, Nath. Season, Perryam, Rollinson, Jack Linbad, Spicelogas, Turner, Tycho Oxoniensis, &c.

Publication.—The first number was "printed for M. Cooper, in Paternoster Row, and sold by S. Farrer in Charterhouse-street, London, 1745." The whole of the six numbers published were collected into a volume, which was "printed for John Wilcox, in the Strand, London, 1751:" so that most probably the publication took place annually.

THOMAS WILKINSON.

Burnley, Lancashire, December 25, 1848.

Postscript.

My reasons for the opinion formed as to the mode of publication, are the following:—

1. In one of the copies of the *Mathematician* in my possession, there are *two* title-pages, the second of which runs thus:—

"The Mathematician. No. I. Contain-

* Or rather, in truth, amongst the final set of questions in the last number of the *Leeds Correspondent*, the solutions to which were not published owing to the discontinuance of the work. This was the usual practice. The *Enquirer* adopted the unsolved questions of the *Quarterly Visitor*; the *Leeds Correspondent* those of the *Enquirer*; and the *Receptacle* those of the *Correspondent*.

The same gentleman resumed this subject in vol. vi. N. S. of *Leybourn's Repository*, seventeen or eighteen years ago; and collected together all that appeared to have been previously done with respect to this theorem, besides giving an original demonstration. The chief value of that more recent undertaking, however, consists in the number of curious, difficult, and unexpected properties of the trapezium which are there given and investigated for the first time. See pp. 124—136, 229—234, and the last sheet of "new questions," to which answers have never yet, to my knowledge, been given.

It is much to be desired that a classification of the properties of the complex, as well as the simple quadrilateral, should be composed, by some geometer who has given adequate attention to this subject, and to whose mind the best methods of investigation are familiar.

ing a Dissertation on .. .. .. Geometry. Also, The Chief Properties of the Parabola, ... elegant manner. Together with a Collection .. .. , never before published

By a Society.

Magna est .. .. prævalebit.

London.

Printed for M. Cooper, in .. .., and sold by S. Farrer, in .. .. , and by all the Booksellers in London and Westminster."

MDCCXLV.

[Price One Shilling.]

2. The holes made by stitching No. I., pass through the *second or original* title-page printed with the number, but *not through the first title-page*;—evidently proving that the title bearing date 1751 was printed when several, if not all, of the numbers were published.

3. The *stitching holes* of all the numbers are quite perfect, but none of them correspond;—evidently proving that the volume has been bound up from numbers stitched at different times.

4. Each number contains a "Collection of Problems to be answered in the *next* number." In one copy which I possess, the *original* title has been *torn out*, so that the one dated 1751 is the only one remaining. The volume, I observe, has been bound up from *sheets*, as no *stitching holes* are apparent. THOS. WILKINSON.

[The following extract from "Hutton's Life of Simpson," prefixed to the edition of the "Select Exercises" of 1792, may not be here unacceptable:—

"It has also been commonly supposed that he (Simpson) was the real editor of, or had a principal share in, two other mathematical works of a miscellaneous mathematical nature; viz., the *Mathematician*, and *Turner's Mathematical Exercises*, two volumes in 8vo., which came out in periodical numbers in the years 1750 and 1751, &c. The latter of these seems especially to have been set on foot to afford a proper place for exposing the errors and absurdities of Mr. Robert Heath and the *Palladium*; and which controversy between them ended in the disgrace of Mr. Heath, and expulsion from his office of editor to the *Ladies' Diary*, and the substitution of Mr. Simpson in his stead, in the year 1753."

We commend "Turner's Exercises" to Mr. Wilkinson's notice for a future article of this interesting series of papers; and we would suggest that any of our readers who may happen to fall in with any collateral information, or meet with anything bearing upon our periodical mathematical history, the great service they would be rendering to the archæology of science, by communicating such matters to Mr. Wilkinson.—ED. M. M.]

MAGNIFICENT POULTRY HOUSE.

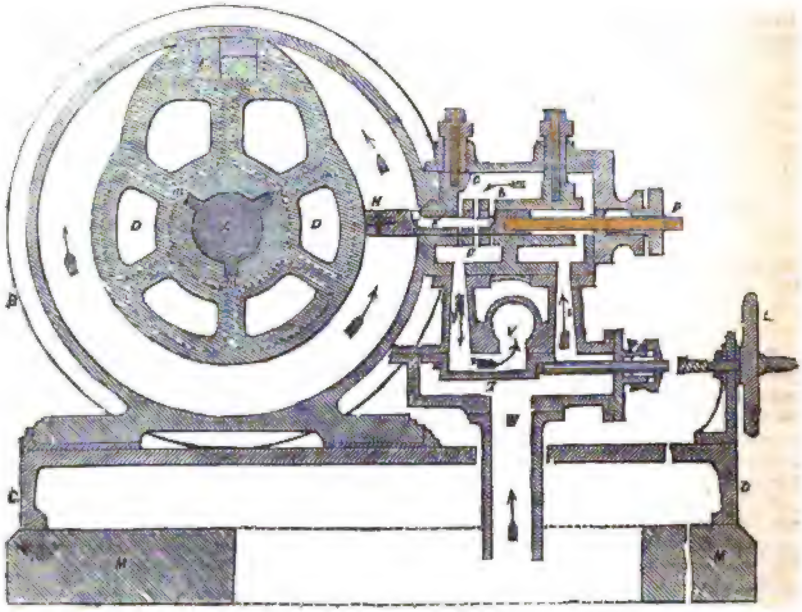
We extract the following account of Lord Penrhyn's poultry-house from "The Poultry-Yard," by Mr. Peter Boswell:—

"The most magnificent poultry place, perhaps, that ever has been built, is that of Lord Penrhyn's, at Winnington, in Cheshire. It consists of a handsome regular front, extending about 140 feet, at each extremity of which is a neat pavilion, with a large arched window. These pavilions are united to the centre of the designs by a colonnade of cast-iron pillars, painted white, which support a cornice, a slate roof, covering a paved walk, and a variety of different conveniences for the poultry, for keeping eggs, corn, and the like. The doors into these are all of lattice-work, also painted white, and the framing green. In the middle of the front are four handsome stone columns, and four pilasters, supporting likewise a cornice, a slate roof, under which and between the columns is a beautiful mosaic iron gate; on one side of this gate is an elegant little parlour, beautifully papered and furnished; and at the other end of the colonnade a very neat kitchen. The front is the diameter or chord of a large semicircular court behind, round which there is also a colonnade, and a great variety of conveniences for poultry. This court is neatly paved, and a circular pond and pump are in the middle of it. The whole fronts towards a rich paddock, in which the poultry have the liberty to walk about between meals. The house is built of brick, except the pillars and cornices, the lintels and jambs of the doors and windows; but the bricks are not seen, being all covered with a remarkably fine kind of slate from his lordship's estates in Wales.

MR. DAVIES'S SINGLE PISTON ROTARY ENGINE.

Sir,—A few weeks since you published in your Journal an abstract of the specification of a patent for an improved rotary engine recently granted to Mr. Isaiah Davies, of Birmingham. You observed that Mr. Davies had obtained a patent for a rotary engine about four years previously, and your readers must have perceived, that the claims lately patented are for the most part for additions to and improvements in the original engine. I am not aware that any account of that engine has appeared in the pages of your Magazine. And as, after the favourable allusion you have made to it, many readers may feel interested in the matter, I propose to give you a description of it, accompanied by a section of an engine constructed by Mr. Davies, about twelve months ago, which has ever since been constantly at work in a manufactory, that is to say, working on an average about eleven hours a day.

The number of figures which illustrated



your description of the improved engine must have rendered the general principle, form, and arrangement, of the engine familiar to your readers, and the simple sketch which accompanies this, will therefore, I think, be found sufficient for our present purpose. M is a stone pediment; C, the cast metal foundation plate on which the engine is fixed; B is the body of the engine, 24 inches internal diameter, and 15 inches deep. There are two of these cylinders placed symmetrically on the same axis; they are held together by bolts through the flange, but a partition plate separates them, and thus divides the body of the engine into two distinct parts or chambers. Within each chamber a piston revolves; one of these pistons, D, is seen in the figure; it is of a cylindrical form, with a projection E, occupying about $\frac{1}{16}$ of its circumference. The diameter of the cylindrical part of the piston is 17 inches, so that the annular space between it, and the fixed cylinder, B, is 3½ inches. The projection extends across the annular space, and forms an inflexible piston for the steam to impinge against. In the projection there is a packing piece, *e*, fitted into a groove, and pressed against the outer cylinder by means of a blade spring. This packing piece is placed in an oblique position as indicated by the dotted lines.

The two pistons are attached to the shaft, A, so that the projection, E, in each one are on opposite sides of the shaft, which prevents any dead point during the revolution.

G is a chamber or box, which is cast or attached to the fixed cylinder, B, within which is a partition-plate, *b*, attached to the cover of the box, G, and regulated by adjusting screws; *c* is a nozzle plate, also enclosed within the box, or chamber G. Both the partition, and nozzle plate are slotted in the manner shown in the section.

F is the steam stop, which slides between the partition and nozzle plates, and enters the fixed cylinder, B, through a rectangular slot of exactly the size to admit it; the length of the slot is equal to the depth of the cylinder, and the breadth coincides with the distance between the partition, and nozzle plates.

The stop or slide, when within the cylinder, stretches across the annular space,

H, and is only removed back within the chamber, G, to make way for the projection on the piston as it passes the slot, through which the steam stop slides. The steam stop is made of brass, and is cored out to correspond with the slot in the partition and nozzle plate, and to admit of the steam passing freely through, both in and out of the cylinder, as indicated by the arrows.

The further edge of the slide which presses against the piston is fitted with a tongue, *u*, in a groove. Behind the tongue is a blade spring pressing against it, which keeps the stop steam tight with the cylindrical part of the piston against which it rubs.

A cam movement attached to the shaft A, communicates the requisite motion to the the stop F, by means of the rod P—l.

V and W are the supply and eduction pipes; Z, *a*, D, valve for starting, stopping, and reversing the engine; L, wheel for working the D valve.

Your readers will not fail to perceive that the principle of the engine last specified is the same as this—the chief difference being, that the former was a single acting engine, whilst this latter is a double acting one.

Your remarks as regards the favourable performance of the engine are perfectly correct. About nine months ago I was called upon professionally to examine this engine, and to give an opinion of its merits. I confess it was with some misgiving that I went to Birmingham to see it, and I felt at the time but little doubt in my own mind, but that I should be compelled to condemn it; for at the time, in common with many other engineers, I felt (if not a prejudice) at least a strong opinion against the rotary principle of construction. This prejudice was much shaken when I first saw this engine at work, and subsequent experiments entirely dispelled it.

I have since critically examined and repeatedly tried experiments with Mr. Davies's engine, and can without hesitation express my unqualified approbation of it, and certainly think, that ere long, it will maintain with others a favourable competition in the market. This opinion is not hastily formed, but drawn from practical observations. In a few weeks I shall be enabled to give your readers the particulars of my experiments, and then they will be better able to form an opinion on the matter.

I remain, Sir, yours obediently,

William Dredge.

London, 10, Norfolk-street, Strand,
December 20, 1848.

OSCILLATING STEAM ENGINES—AMERICAN AND ENGLISH PENDULUM ENGINES.

Sir,—On receipt of your Magazine, of the 16th ult., I at once recognised in the frontispiece "an old friend with a new face"—in fact, a bantling of mine in bygone days, which never repaid my fostering care, nor ever attained maturity. It was in March, 1831, that I sent you for insertion in your Magazine a short account of a scheme I was then contemplating, for an improvement in oscillatting engines for locomotive purposes, the peculiarity of which consisted (like Messrs. Want and Vernum's,) in "centring the cylinders at their ends (instead of the middle, as usual,) upon transverse hollow trunnions through which the steam was to be inducted and discharged." The publication (at that time premature) was made in consequence of finding myself anticipated in this arrangement, by the pendulum engine of Mr. E. A. Lester, set up in the Navy-yard, at Charlestown, Massachussetts, U.S., and fully described in No. 398 of the *Mech. Mag.* The great simplicity of this form of engine, the fewness of its parts, and the small space occupied, as well as its favourable action on the crank, seemed to me to be matters of considerable advantage; these, and almost every other possible point of merit seems to have been exhausted in the enumeration of the American writer, quoted at page 51 of your 15th volume. On subsequent investigation, however, I found many of these asserted advantages fallacious, especially that on which I had originally laid most stress, viz., the capacity of the engine for working at high velocities. The American author gives it as his opinion that "the *pendulum engine* admits of being run with greater velocity than a fixed engine of similar proportions, and the influence of gravity, instead of hindering, rather favours its being driven with much greater velocity. A few preliminary experiments, however, sufficed to show me the fallacy of this supposition. Pendulums of given

dimensions, vibrate *in accordance with gravity*, only in *fixed times*. To drive them *faster* or *slower* than this *definite speed* is to oppose gravity, which becomes a retarding force, and an absorbent of the motive power. Experience has likewise shown in a variety of disastrous events, that large masses of matter moving with high velocities, cannot easily be made to overcome the momentum generated, or reverse its direction. The working beam of Watt's condensing engine moving at moderate velocities, changes its motion alternately in obedience to the rotation of the crank, without any serious mischief arising; but if we attempt to drive an engine of this class at the speed of our locomotives, what result might we expect? Why just what actually happened more than once on the Croydon Atmospheric Line, when the pumping (beam) engines being pushed to a high speed, their massive beams were snapped like glass. The greater the mass, and apparently the strength, so much greater is the disruptive energy of the *vis inertia*. It follows then, as a matter of practical wisdom, that we should keep all those parts of machinery that move alternately in opposite directions—especially at high velocities—as *light* as is consistent with adequate strength, and in perfect *equilibrium*. We should also make, as far as circumstances will admit, all the large and heavy parts of our machines fixtures, and give motion only to the lighter parts. This subject is, happily, every day becoming better understood, and for this, practical men lie under no small obligations to Mr. George Heaton, of Birmingham, whose investigations in this particular department of dynamics have been invaluable.* Mr. Heaton's public experiments on the prejudicial influences of unbalanced moving parts, and the necessity for perfect equilibrium, have been most satisfactory and convincing—amounting in fact to positive demonstration.

Applying these well established principles then to the *pendulum oscillating engine*, its unfitness for high velocities becomes manifest. In attempting to drive a locomotive constructed on this principle at the ordinary speed of forty miles an hour, the piston-rod would be "doubled up" before half that speed was attained. The rapid alternating movement of the heavy oscillating cylinders, would generate an antagonistic momentum that nothing could long withstand. Applying the foregoing principles to test the theory of the American advocate of the *pendulum engine* before quoted, it will be found that the greater part of the advantages claimed for it have no existence in fact.

Whether there is sufficient novelty in the arrangement of Messrs. Want and Vernum's engine to support their patent, I stop not to inquire; but if twenty years' publicity and experience have been insufficient to obtain for this mode of construction any share of public favour, the prospects of the future are not the brightest.

For boat-engines, and other purposes where light and simple engines are required, I think they may perhaps be advantageously employed.* For locomotive purposes, however, it is inapplicable nor can I regard the patentee's proposal to join two cylinders together, end to end, working on a trunnion *in the middle*, in any other light than a departure from the essence of their improvement.

I remain, Sir, yours respectfully,

WM. BADDELEY.

29, Alfred-street, Islington, Dec. 19, 1848.

THE "TIMES" PRINTING MACHINE.

Sir,—Permit me to correct a slight error in your late notice of the new machine for printing the *Times*. It is there stated, that "it was expected to throw off 14,000 impressions per hour." Now I only promised, and the legal agreement provides for, 8000, which the machine already regularly performs. It is probable that it will be driven quicker, as the type, in performing its circuit of 200 inches, moves only 24 inches more than *the wheels* in the flat machine, and as the rotary action of the new machine avoids the concussions made by the reciprocating motions of the flat type table and its heavy appurtenances, I have supposed that the new machine may be driven at the same rate as the old ones,

* *Vide* vol. xxxvi., p. 297—also vol. xlii., p. 435.

* We stated expressly in our account of Messrs. Want and Vernum's engine, that we thought it chiefly adapted to engines of small power.—ED. M. M.

whereby the produce (in any case) would be double.

The last flat machine at the *Times*, made by Messrs. Dryden, and those at the *Daily News*, made by Mr. Middleton, each strictly on the model of the first four-cylinder machine combined by me in 1827, are driven up to 5,500, and upwards, whenever required; therefore, I shall not be surprised at 10,000 or 11,000 impressions from the new machine.

But the *possible* production of the new principle ought not to be rated by the *first new machine*—for if the surface of the typeholders (or "turtles," as our American friends call them) could have been circular, instead of segmental, ten printing cylinders, of small diameters, could have been placed round the central type-drum, instead of eight larger ones, by which alone 2000 more impressions per hour would have been yielded at the present rate of motion.

And further, in cases where space is deficient, instead of having two machines, as intended at the *Times*, two forms and two distributing tables may be placed upon the type-drum, and for which there is ample room; so that with an upper-story of feedboards, and two sets of cams for regulating the entrance and exit of the paper, a double set of impressions may be obtained from each revolution of the type, or 20,000 impressions per hour.

Having trespassed so much upon your space, allow me to explain the principal cause of delay in the completion of the first machine. The sheet of paper, after being stopped in its descent from the ordinary feedboard, has to be started and moved *sideways* towards the impressing cylinder. This is done by sets of horizontal endless tapes, passing over and around small drums and rollers, which revolve in a vertical direction, in order to avoid the noise of about 130 small wheels. I drive these vertical rollers and drums by bands and wide tapes, *their only function being to carry the sheet of paper;* yet, owing to friction, or some other cause not quite ascertained, an occasional irregularity occurred in the side passage of the sheet to the impressing cylinders, which, having wheels in gear with the type-drum, necessarily kept exact time with it; and the rate of motion being about 60 inches per second, an error in the time of arrival of the sheet of paper of one tierce, *or the 60th part of a second*, would make an error of an inch, and sometimes throw the margins wrong. Since the introduction of wheels, the paper and type kept exact time with each other, and the "waste," or sheets spoiled, are fewer than in the old machine.

The vertical system has incidental and unforseen advantages. When the sheet of paper is suddenly stopped, any dirt or flue is shook out of it, and falls upon the floor, whereas in the flat machine *it falls upon the form or ink-table*, so that an impression of 35,000 is worked off without once brushing the form, which is also by virtue of the vertical position touched with ink only on the surface of the type, none falling into the spaces or blanks in the form. I am, Sir, yours, &c.,

A. APPLEGATH.

Dartford, Jan. 2, 1849.

WOODCROFT'S SKETCH OF THE HISTORY OF STEAM NAVIGATION.*

Mr. Woodcroft remarks with truth (Pref.), that "although much has been written and published on the subject of steam navigation, the merits of the several inventions by which it has been brought into practical operation, have not in all cases been faithfully recorded or duly assigned to their respective authors." The great object, therefore, of Mr. W.'s present Sketch is to remedy this defect; "firstly, by a chronological enumeration of the several projectors, whether subjects of Great Britain or foreigners; and secondly, presenting to the reader a clear and impartial statement of what has been accomplished by each, viewed either as an original inventor or as having been instrumental in promoting the means by which steam navigation has reached its present state of excellence."

We think Mr. Woodcroft has accomplished the useful task which he has undertaken in a very fair and honest spirit; done, too, excellent service to the cause of

* A Sketch of the Origin and Progress of Steam Navigation, from authentic documents. By Bennet Woodcroft, Professor of Machinery in University College, London. With numerous plates and woodcuts. 140 pp., fcap 4to. Taylor, Walton, and Maberly.

historical truth—less, however, by novelty of matter, than by a more careful reference to original authorities than has been usual with preceding writers, and by a more faithful use of the facts which they supply. His general course is to exhibit the pretensions of each inventor in his own words; and where such unerring landmarks are wanting, he greatly prefers the reflected light of contemporaneous authorities to the glosses and guesses—the "must have beens" and "may have beens"—of later commentators. His judgments are, for the most part, unexceptionable, and such, we believe, as will bear the test of the most rigid investigation; though being, as they professedly are, of a "sketch"—y — character, there is at times an inconvenient manifestation of the writer's reliance on the reader's own intelligence, for the reasons on which they are founded.

Passing over the very apocryphal story of the "Spanish Sea Captain," Blasco de Garay, as unworthy of any serious regard, and the vague "oracles" of Worcester and his numerous class, as only better in being more authentic, Mr. Woodcroft pronounces Watt's patent of 1769 to have been "THE FIRST STEP FOR APPLYING THE STEAM ENGINE TO THE PROPULSION OF VESSELS."

On the 5th of January, 1769, JAMES WATT obtained a patent for improvements in the steam engine, one of which, namely "the fourth," was for causing the steam to act above the piston as well as below it, and which engine is called "the double impulse" or "double acting engine." This improvement in all cylinder engines is here mentioned in consequence of its having been the first step by which the steam engine was rendered capable of being successfully used to propel a vessel, which great improvement was applied to the *first practically propelled steam-boat*, as will be hereafter shown, and is still used in the present system of steam navigation. p. 14.

The SECOND GREAT STEP was the invention (1780), by *Pickard*, of the crank movement.

Thomas Pickard obtained a patent in 1780, the title of which is, "His New Invented Mill or Machine, upon an entire New Construction, which will be of great advantage in various Manufactories, such as Rolling, Turning, Boring, Grinding of Corn, and all other sorts of Grinding; Forging, Flattening, and Hitting of Iron, and every other Work that a Mill is capable of performing by a Rotative Motion, which he considers will be of great public utility." This invention is no other than the present connecting rod and crank, and a fly-wheel; and here we have the second and last great improvement in the steam engine, which enabled it to be of service in propelling vessels. p. 16

The claims of *Mr. Miller, of Dalswinton*, who has been very perseveringly put forward by his family as having been the real "father of steam navigation," are limited by Mr. Woodcroft to his having first employed *paddle-wheels "similar to those now in general use,"* for the propulsion, by manual power, of vessels, and to his having been the liberal patron of WILLIAM SYMINGTON, who was the first person who actually drove paddle-wheels *by steam*.

James Taylor, another of the *soi-disant* "Fathers," is considered to have been a mere hanger-on at Dalswinton House, who introduced Symington — as any Gil Blas might have done—to the great man's notice.

Mr. Taylor's connection with steam-boat experiments ended with those of the second boat in 1789; and it is clear, from his own statements and those of his friends, that he was neither the inventor of the machinery by which either of those boats was driven, nor of the mode of connecting the engines to the boat and wheels. This, it is admitted by Mr. Taylor and his friends, was done by Symington. Neither was Mr. Taylor the first person to suggest the use of the steam engine to propel boats. His merits, then, with reference to the origin and progress of steam navigation, rest entirely upon his having successfully urged Mr. Miller to try steam-boat experiments, and in having devoted his time and attention in superintending the preparation of his boats for trial. Mr. Miller, it is evident, availed himself of the advice and assistance of Mr. Taylor in his several experiments; but as these experiments were made at the sole cost of the former gentleman, it must be indisputably admitted that to him we are indebted for the successful introduction of the present system of steam navigation at the early period here mentioned. p. 40.

Mr. Woodcroft's views of the comparative merits of SYMINGTON and *Taylor* coincide entirely with those which we have ourselves long ago and frequently expressed

(*Mech. Mag.*, vol. xxxv., p. 130.) We shall, however, give in Mr. Woodcroft's own words, the grounds on which he rests his adhesion to the supereminent claims of SYMINGTON:—

In the year 1801, the late Thomas Lord Dundas, of Herse, who was acquainted with the experiments that had been made by Mr. Miller, and who was an extensive proprietor of property in the Forth and Clyde Canal, employed Mr. Symington to make a series of experiments on steam-boats, and to enable them to be substituted for the horses then employed to draw the vessels on the canal. These experiments occupied a period of time from January, 1801, to April, 1803, and the cost of them is stated to have amounted to a sum exceeding £7000.

The result of these experiments was the production of the "first practical steam-boat," named the *Charlotte Dundas*, in honour of his lordship's daughter, the late lamented Lady Milton. This vessel might, from the simplicity of its machinery, have been at work to this day, with such ordinary repairs as are now occasionally required to all steam-boats.

In this vessel there was an engine with the steam acting on each side of the piston (Watt's patented invention), working a connecting-rod and crank (Pickard's patented invention), and the union of the crank to the axis of Miller's improved paddle-wheel (Symington's patented invention.) Thus had Symington the undoubted merit of having combined together, for the first time, those improvements which constitute the present system of steam navigation.

In the month of March, 1802, Mr. Symington took on board this vessel, at lock No. 20 of the canal, Lord Dundas, the Hon. George Dundas, R. M.; Archibald Spiers, Esq., of Elderslie, and several other gentlemen; and after having attached to the steam-boat two other boats, each of seventy tons burden, named the *Active* and *Euphemia*, it towed those vessels to Port Dundas, Glasgow, a distance of nineteen miles and a half, in six hours (being at the rate of three miles and a quarter per hour), although it blew so strong a gale right ahead, during the whole day, that no other vessel on the canal attempted to move to windward.

Proofs having been given of the efficiency of this vessel to supersede horses for towing, proposals were made to the proprietors of the Forth and Clyde Canal to adopt it; but from an opinion that the waves it created would damage the banks, and thereby cause injury to a greater extent than any benefit that might accrue, the proposal was rejected. Lord Dundas, however, entertained a more favourable opinion on the subject, and called upon the Duke of Bridgewater for the purpose of recommending the adoption of Symington's steam-boat. His Grace at first appeared to doubt the utility of the invention; but after having seen a model, and received explanations from Mr. Symington, he gave him an order to build eight boats, similar to the *Charlotte Dundas*, to ply on his canal.

Mr. Symington returned to Scotland, elated with the prospect of being able to introduce steam navigation in a short time, and to realize to himself the advantages which his ingenuity and unwearied perseverance gave him reason to anticipate; but he was doomed to disappointment—for, on the same day that he was informed by Lord Dundas of the final determination of the committee not to allow steam-boats to be employed on the canal, he received intelligence of the death of the Duke of Bridgewater.

Unable longer to struggle against his misfortunes—his resources being exhausted—he was obliged, with great reluctance, to lay up his boat in a creek of the canal, near to Brainsford draw-bridge, where it remained for a number of years exposed to public view.

From the experience that Symington had obtained in his experiments with Mr. Miller's boats, and from the circumstance of the double-acting cylinder and crank being at the time of his engagement by Lord Dundas used in stationary engines, he abandoned his own old engine, and obtained a patent for applying a double-acting reciprocating engine to a boat, and for placing his crank upon the axis of the paddle-wheel, which was a good subject-matter for a patent, and a very important discovery and improvement. From the establishment of this combination of machinery to a boat, no improvement on this system has ever to the present time been effected, either in this or in any other country; and this, the parent boat of the present system of paddle-wheel steamers, is represented from a drawing by the late Mr. Symington himself. p. 53.

FULTON is frankly recognized as having been the author of steam navigation *in America*; but he is denied at the same time all claims to the character of an original inventor. Literally and truly speaking, *he invented nothing*.

It may be supposed, from what has already been said of Fulton, that he had made some great improvements in the machinery of steam-boats, or in the boat itself;

and some American authors go so far as to say, that he was the inventor of steam navigation.

Fulton is entitled to the undoubted and great merit of having introduced steam for practical purposes; but he was not the inventor of the system which he thus introduced.

Colden says, "He conceived the idea of propelling vessels by steam as early as 1793;" and in some of his manuscripts, he speaks with great confidence of its practicability.

In 1796, however, he published, in London, a Treatise on Canal Navigation, in which he makes no mention of steam-boats.

In 1801, Mr. Fulton was in Paris, and thus had an opportunity of conversing with Chancellor Livingstone, at that time the representative of the United States at the court of France, on the subject of steam navigation.

"Mr. Fulton," says Colden, "in conjunction with Robert Livingstone, Esq. (who had formerly been associated with Stevens in America in making experiments in steam navigation), built an operating boat upon the Seine, for which an engine was ordered in England. This experimental boat, which was 66 feet long and 8 feet wide, was completed in 1803. When on the point of making the first experiment, the weight of the machinery broke the boat into two parts, and they went down together. The repairs were completed in July. On trial, however, the boat did not move with as much speed as Mr. Fulton expected.

The combination of the machinery applied to this boat is not specified; but assuming it to have been similar to that subsequently adopted for the *Clermont* in 1807, it may be compared with the inventions specified by Symington in his patent of 1801, namely, a cylinder with steam acting on each side of the piston, with an air pump and detached condenser (Watt's invention), connecting-rods and cranks to obtain rotary motion, and a fly-wheel to get over the dead points of the engine (Pickard's invention); improved paddle-wheels (Miller's invention); and the combination of these instruments together for the first time in a boat (Symington's invention). In fact, if these inventions, separately or as a combination, were removed out of Fulton's boat, nothing would be left but the hull; and if the hull could then be divested of that peculiarity of form admitted to have been derived from Colonel Beaufoy's experiments, all that would remain would be the hull of a boat of ordinary construction.

The Americans admit that they are indebted to Fulton for the art of steam navigation, and it will be proved that he obtained that art entirely from the inventions of British subjects.

Mr. Fulton having heard of the successful experiments of Symington, was naturally led, by his desire to accomplish the same end, to pay Symington a visit, the result of which is thus circumstantially related: "It happened one day during the month of July, 1801, while Mr. Symington was conducting his experiments under the patronage of Lord Dundas, a stranger came to the banks of the canal, and requested an interview; he announced himself as Mr. Fulton, a native of North America, to which country he intended to return in a few weeks; but having heard of the steam-boat experiments, he could not think of leaving Scotland without waiting upon Mr. Symington, in the hope of seeing the boat and machinery, and procuring some information as to the principles upon which it was moved. He remarked, that however beneficial the invention might be to Great Britain, it would certainly be of more importance to North America, considering her many navigable rivers and lakes, and the ease with which timber could be procured for building such vessels and supplying them with fuel. He thought fit further to say, that the usefulness of steam vessels in a mercantile point of view could not fail to attract the attention of every observer; and that if he was allowed to carry the plan to North America it could not but turn out to Mr. Symington's advantage, as if inclined for it, or his other engagements would permit, the constructing, or at least the superintending the construction of such vessels, would naturally devolve upon him. Mr. Symington, in compliance with the stranger's earnest request, caused the engine fire to be lighted up, and the machinery put in motion. Several persons entered the boat, and along with Mr. Fulton, were carried from lock No. 16, where she then lay, about four miles west; and returned to the place from whence they had started in one hour and 20 minutes (being at the rate of six miles an hour), to the astonishment of Mr. Fulton and the other gentlemen present.

Mr. Fulton asked and obtained leave to take notes and sketches of the form, size, and construction of the boat and apparatus, but he never afterwards communicated with Mr. Symington.*

Further and more ample testimony to the truth of Fulton having thus ascertained, by personal investigation, a knowledge of the means by which Symington propelled his boat, might be readily given; but the following extracts, which fully corroborate the

* Bowie on Steam Navigation, p. 14.

preceding statement, will suffice to establish the fact.

The first is an affidavit, "Robert Weir, residing at Kincardine, in the county of Perth, in that part of the United Kingdom called Scotland, maketh oath, and sayeth, That he is acquainted with William Symington, engineer, at Falkirk. That he was employed by him for several years. That in the year 1801, he remembers of Mr. Symington erecting a boat and fitting a steam engine into it, and dragging two vessels along the Forth and Clyde canal, by means of the said steam-boat. That the deponent was employed as engine fireman on board the said boat. That during the experiment, the now deceased Thomas Lord Dundas and several gentlemen were on board the steam-boat. Deposes that the following persons, now living, were also on board, viz., Alexander Hart and John Allen, shipbuilders, Grangemouth; and John Esplin and William Gow, shipmasters there. That some time after the first experiment, while the boat was lying upon the canal, at lock No. 16, it was visited by a stranger, who requested to see the boat worked.

"That the said William Symington desired the deponent to light the furnace, which was done, and the stranger was carried about four miles along the canal, and brought back. That this stranger made inquiries both as to the mode of constructing and of working the boat, and took notes of the information given him by the said William Symington.

"That the deponent heard the stranger say his name was Fulton, and that he was a native of the United States of America. That the deponent remembers Mr. Symington remarking, that the progress of the boat was much impeded by the narrowness of the canal, to which Mr. Fulton answered that the objection would not apply to the large rivers of North America, where he thought the boat might be used to great advantage.

"Sworn at Blair Castle, in the county of Perth, upon the twenty-third day of October, one thousand eight hundred and twenty-four, before me, one of His Majesty's justices of the peace for the county of Perth,

(Signed) "ROBERT WEIR,
"ROBERT DUNDAS, J.P."

The next testimony is that of Mr. Jacob Perkins, a native of America, who has long resided in this country, and who has acquired a high reputation by his mechanical ingenuity. Mr. Perkins, in reply to a letter from Mr. Bowie on the subject, thus writes:—

21, Great Coram-street,
Feb. 15th, 1834.

Dear Sir,—In answer to yours of the 5th instant, I can only say, that so much time has elapsed since any conversation passed between Mr. Fulton and myself on the subject to which you allude, that I have but an indistinct recollection of what occurred between that gentleman and myself respecting his first idea as to the practicability of steam navigation. The impression, however, is on my mind, that he received his first hints from some experiments that he had witnessed in Scotland. I do not remember his ever having mentioned any one being concerned in making these experiments in that country but Mr. Symington.

I remain yours very truly,
(Signed) JACOB PERKINS.

Mr. Bowie.

After witnessing the experiments of Symington, Mr. Fulton ordered from Messrs. Boulton and Watt, of Soho, near Birmingham, a steam engine for propelling a boat intended to be built in America.

This engine reached its destination before the *Clermont* was launched, and, with the assistance of the working engineer who had accompanied it from Soho, it was fixed in that boat.

The engine differed very little in size from that of the *Charlotte Dundas*, whose piston had a four-foot stroke, and was 22 inches in diameter, whilst that of the *Clermont* had also a four-foot stroke, and was 24 inches in diameter. Such similarity in the dimensions of these engines cannot easily be imagined to have arisen accidentally.

Now if Fulton had been, as has been assumed, the inventor of steam navigation, it is clear that he must have made the discovery before the period at which the *Clermont* was launched; and having made so great a discovery, one would be led to imagine that he would have secured to himself by letters patent, at an early period, that particular arrangement of machinery by which steam navigation became practicable, and was subsequently introduced into America.

But such is not the case; for it was not until the 11th February, 1809, that he obtained his first patent in America for propelling, and the second for the same purpose he obtained on the 2nd October, 1810.

That there may be no room left for Brother Jonathan to cavil about the extent of Fulton's pretensions, Mr. Woodcroft gives nearly *in extenso* the American specifications, and thus, in conclusion, disposes of them:—

Fulton's specifications are here given at much greater length than was at first intended, as any attempt at abridgment, however faithfully executed, might be viewed with suspicion. His claims are set forth in his own words; and from these it will be evident that he was not the inventor of the present system of steam navigation. His calculations of forms and proportions were wholly founded on those of Colonel Beaufoy; he made use of Boulton and Watt's steam engine, including the sun and planet motion, to propel his boats; and amply availed himself of the invention of Symington, as specified by him, and actually carried into practice with the *Charlotte Dundas*. Fulton's patents and specifications must therefore be considered as mere importations, borrowed (in patent phraseology) from "foreigners residing abroad," or as barefaced plagiarisms. The dimensions of his first boat, as given in the second specification, differ from those by his biographer, and by Mr. Charles Brown, by whom the vessel was built; and it is even admitted, that for the success of his experiments with the *Nautilus*, which occupied so many years of Fulton's life, he was mainly indebted to the invention of Mr. D. Bushnell."*

(*To be continued.*)

BUSH'S PATENT COMPASS.

Sir,—I have to thank Mr. Baddeley for his very able and unsolicited advocacy (last vol., p. 521) of the merits of my patent compass. I have had, like most inventors of new things, a good deal of prejudice and opposition to encounter; but I am happy to say, that they are giving way at last before the daily accumulating evidence of the superiority of this compass over any yet invented. From many proofs of this in my possession, I select one, which I shall be greatly obliged by your appending to this communication. It is a letter from Commander Galloway, of the screw vessel *Ranger*, an officer of great experience and acknowledged ability and intelligence.

I am, Sir, yours, &c.,
J. Bush, C. E.

Tower Hill, Jan. 1, 1849.

Commander Galloway to Mr. Bush.

Sir,—I have now made three voyages with your patent compass on board, and had opportunities of testing the accuracy of its performance under almost every variety of circumstance; and am happy to say that nothing could answer better. I much prefer it to the compass adjusted according to Professor Barlow's method; for while yours always points true, the indications of the other vary in correctness according to the list of the ship.

I am, Sir, yours, &c.,
A. Galloway, R.N.

To Mr. Bush.

ENGLISH SPECIFICATIONS ENROLLED DURING THE WEEK ENDING JAN. 6.

John Macintosh, Glasgow, gentleman. *For improvements in obtaining motive power.* Patent dated June 28, 1848.

This invention refers to three different varieties of the rotary engine, to be worked by steam or other fluids; and to a flexible valve.

The *first* engine consists of a strong metal cylinder, closed on both sides by suitable covers, and containing an interior cylinder, the ends of which are securely attached to the inside surfaces of the covers. The periphery of the inner cylinder is divided by a central slot, in which travels the piston-rod. This rod is keyed at one end to a main shaft inside the inner cylinder, and carries at the other the piston, which works in the space left between the outer circumference of the inner cylinder. The outside cylinder is fitted with a steam induction and eduction ports, together with a suitable slide-valve and valve-box, into which steam is conducted by a pipe from a generator.

A band of any strong, flexible material, is attached inside the outer cylinder, so as to envelope the circumference of the inner one, with the piston working in its central slot, and is made fast at the two ends up to the space between the two steam ports. The length of the piston-rod is, of course, such as to keep whatever portion of the band it acts upon, in close contact with the inside circumference of the outer cylin-

* The "*Nautilus*" affair is here introduced rather unnecessarily. Bushnell was the author of a "Description of a Submarine Vessel or Torpedo for blowing up ships," 1775; but that had nothing to do with the promotion of *Steam Navigation*. On the contrary, there can be nothing better calculated to neutralize such under-*foot* stratagems than a power which enables a vessel to shift on the instant from one spot to another.—Ed. M.M.

der. The steam pipe is fitted with a valve for regulating the supply of steam to the valve-box, or for working it expansively. The slide-valve and valve-box are so arranged that when one port is opened to admit steam, the other shall be made to open into an exhaust, or into the atmosphere. On steam being admitted by (say) the top port, it will drive the piston round, and consequently the main shaft, until it has passed over the bottom port, when it will escape through it into an exhaust, and so the operation be repeated without interruption. If the slide-valve be changed, the steam will be admitted by the lower port, and the action of the engine reversed. The inner cylinder is filled with any suitable lubricating substance, to diminish the friction between the piston and the band. Another loose flexible band of brass is interposed between the piston and the other band, for the purpose of diminishing the friction and the wear and tear of the first band. If rotary motion is communicated to the main shaft from any prime mover, this engine will be converted into a rotary pump.

The *second* engine is a reciprocating one. The arrangements are similar to the preceding, with the exception of using two valve-boxes instead of one, with their ports and adjuncts placed opposite to one another on either side of the outer cylinder.

The *third* engine is a modification of the first, and consists in dispensing with the inner cylinder, and substituting for the band a tube, the ends of which communicate with one or other of the ports. The free end of the piston-rod carries a roller, which presses the tube up against the inside circumference of the cylinder, and thereby closes it, so that on steam being admitted by one port, it will drive the piston, and thereby the main shaft round until it passes the other port, through which it will escape into an exhaust. The admission of steam into the valve-box is regulated by a peculiar flexible valve, which consists of a thin piece of flexible metal fixed to the outside of the valve-box, just above the aperture for the entry of steam. This strip of metal descends a little way, and is then bent upward and made fast to one end of a vertical metal rod. The valve is supported by a suitably constructed grating.

The tube should be composed of vulcanised India-rubber, interlaced on the outside with cord, and, when so prepared, may be applied outside a cylinder, in conjunction with a ball, as described in the specification of a former patent. This engine may be converted into a rotary pump, by communicating rotary motion to the main shaft from any prime mover.

Claims.—1st. In respect to the first and second engines, the use of one or two belts or bands, as described.

2nd. In respect to the third engine, the use of the tube, and also the flexible valve, as described.

Henry Archer, Shaftsbury Crescent, Pimlico, Middlesex, gentleman. *For improvements in matches, and in the production of light, and in apparatus to be used therewith.* Patent dated June 24, 1848.

These improvements relate, *firstly*, to certain modes of making matches to be used as tapers, whereby, when lighted and required to be used, they may be made to remain in a vertical position (until consumed) without trouble, or the necessity of holding them between the fingers, or fixing them in a hole or socket as hitherto.

Secondly, To the preparation of hydrocarbons or other similar inflammable liquids, so that when used they may not be so liable to smoke as is usually the case at present.

Thirdly, To improvements in night lights.

Fourthly, To the construction of pressure lamps.

And, *fifthly*, to ornamenting chimneys, globes, or shades of lamps, or gas burners.

1. The mode of making matches consists in constructing them of a conical or cylindrical form, with a central wick tipped at the top with some easily inflammable substance, and in attaching to the base a piece of metal, wood, paper, cloth, or other suitable material, for the purpose of preventing the melted wax or other substance from running about when the match is nearly burnt out. Or in inserting the bottom of an ordinary taper match into a piece lead or other heavy metal, which acts as a holder to support it.

2. The hydrocarbons, such as ordinary camphine, or coal tar naphtha, are mixed with wood naphtha, or pyroxylic spirit, in the proportion of one of the former to two of the latter, by measure, whereby it is stated they will be rendered less liable to smoke, and will burn with greater brilliancy than the pure camphine.

It is remarked that although the proportions given are the best in ordinary cases, yet that sometimes the purity of the hydrocarbons may vary, and that consequently the quantity of pyroxylic spirit should be increased or diminished accordingly.

3. The improvements in night lights consist in inclosing either of the inflammable liquids before mentioned, or vegetable or animal oils, in a thin metallic or other case, having an aperture at top, which is closed by paper or other impervious material which can be easily perforated by a pin, so as to allow of a wax wick being inserted therein when required for use. The case may be

made by preference of Rand's patent metal (?) or tin, or brass, or even of wood or earthenware, provided with a thin metallic cover. Another mode of making night lights consists in employing as a wick one of the taper matches, before described, which is placed in the centre of a glass or other transparent vessel, filled with the requisite quantity of oil. The wick being weighted at the base will stand in a vertical position, and will gradually burn down as the oil is consumed.

4. The improved construction of pressure lamps consists in placing the oil, or other inflammable liquid, in a flexible bag made of any suitable impermeable material. This bag is furnished at its lower end with a flat disc, which is made so as to pass easily up or down in the cylindrical base of the lamp, and at its upper end with a second disc furnished with a wick-holder, capable of being unscrewed when a new wick or fresh oil is required. A coiled spring is placed in the metal case, underneath the disc fixed to the bottom of the oil bag, which presses it upwards, whereby the oil is always kept up to the wick to a point very near that of ignition. When it is required to introduce a full bag into the case, the spring must be made to collapse by any suitable arrangement.

5. The mode of ornamenting chimneys and globes consists in corrugating them either spirally or horizontally. *Claims*—

1. Making taper matches, as described, whereby when lighted and in use they may be made to stand in a vertical position without extraneous aid, either from the fingers or by fixing the end of the match in a hole in the lid or other part of the match box, as is usually the case.

2. Preparing camphine, or other hydrocarbons, by mixing them with wood naphtha or pyroxylic spirit, for the purpose of rendering the same more useful for illuminating purposes.

3. Making night lights in the manner described.

4. Constructing pressure lamps for burning oil or other inflammable liquids, in which the said inflammable liquids are contained in a flexible bag or case, from which the said liquid is supplied to a wick by means of pressure exerted externally.

5. Ornamenting glass chimneys and globes for lamps generally, by corrugating them obliquely or horizontally as shown.

Joseph Skertchly, of Ansty, Leicester, gentleman. *For improvements in bricks and in the manufacture of tobacco pipes and other like articles.* Patent dated June 30, 8148.

This invention has, *Firstly*, for its object so to construct and fashion the bricks, used for building purposes, that when the same are required to be covered on either, or both of their faces with plaster, cement, stucco, or other like coating, such coating shall be so dovetailed into the subjacent bricks as to be afterwards detachable therefrom only with great difficulty (if at all). With this view each brick is moulded on the face or faces, which are to be plastered or otherwise covered over, with an under-cut groove, the form of which may be varied at pleasure, so long as it is made broader at the base, or internally, than at the top.

Secondly, The invention consists in working tobacco pipes and other like articles from clay or other suitable substance in a much more expeditious and economical manner than the same has been hitherto accomplished; and the improvements in this branch of the invention have relation to each of the processes called *preparing the clay*, *forming the roll*, *boring the roll*, *wiring the roll* and *firing the pipes*.

Preparing the Clay.—The clay is soaked in the usual manner, and then, instead of breaking up the lumps by beating, in order to reduce the mass to one uniform degree of consistency, it is passed through a machine which consists of two metallic rollers revolving on their shafts or axes, on which are keyed two toothed wheels which take into each other. These rollers are driven at different speeds by a pinion fixed on the shaft of a fly-wheel, and the clay is supplied between the rollers from a hopper: the distance between the rollers is regulated by a set screw, and one of them is flanched on the rim to prevent the clay working out at the sides. On the clay (or other suitable material) being placed in the hopper, motion is, by the turning of the handle, communicated to the rollers through the toothed wheels, which are of such relative numbers, that one of the rollers shall revolve three times while the other completes one revolution. The clay is by this operation drawn from the hopper, and in passing between the rollers becomes thoroughly beaten up and amalgamated.

Forming the Roll.—For this purpose the clay is forced into a vessel, to the end of which is affixed one or more plates, perforated according to the thicknesses of the stem required for the pipe, and divided through the centre of the perforations, in order that they may open successively to admit various thicknesses of clay for the stem, and a sufficient substance at the end of the stem for forming the bowl of the pipe. Guides are screwed firmly into the vessel, and pass through slots into the plates. The heads of these guides project beyond

the slots, and keep the plates from being forced away from the vessel, while at the same time they allow the plates to move freely up and down. The plastic clay in the vessel being forced onwards towards the plates, must necessarily pass out through the apertures therein, in the order in which they are placed. Thus, suppose all the plates were closed, and that the clay were propelled forward, it would escape of thicknesses and shapes throughout corresponding with those of the smallest apertures. When the greatest thickness of clay has passed through the required length for forming the bowl, the plates simultaneously close, by means of springs acting on them, and are ready for a repetition of the operation. In order, however, to make the stem taper, the plates are made to open gradually instead of suddenly, and the roll is produced of a gradually increasing diameter. The mode in which the machine operates for forcing the clay through is as follows:—The exact quantity of clay required for making any given number of rolls is laid on a bed, and by turning a handle, motion is transmitted through the gearing to a crank rod, which propels a piston which carries the opening bars onward towards the perforated plates, and at the same time forces the clay from the bed into the vessel. As soon as the clay begins to emerge from the apertures, the points of the opening bars come between the rollers on either side of the machine; and as the bars continue to advance, the plates are gradually and equally opened both upwards and downwards, until the stem has acquired its full length; whereupon the shoulders of the opening bars come suddenly into contact with the rollers, and open the plates wide enough to allow the substance for the bowl to escape; immediately after which the piston begins to return, and the plates close in the reverse order to that in which they were opened. Instead of perforated plates, divided through the centres of the apertures, being employed for forming the rolls, dies or bushes may be fitted into the large opening for the bowl end of the roll, and arranged so as to expand when required exactly in the same way as before described.

Another machine, suitable for forcing out the rolls, consists of a frame carrying a cylinder or vessel for holding the clay, and of a piston which travels on a screw, and carries a wheel underneath, which takes into a worm attached to a main shaft. On the end of the cylinder plates are fixed, similarly constructed to those already described, and which are opened and closed by the same or similar means. The cylinder is now filled with clay, and on motion being given to the handle, the piston begins to advance, and a continuous stream of rolls to be given off from one end of the machine, until the cylinder is exhausted of its clay. The motion of the handle is then reversed, and the cylinder refilled to continue the operation. Instead of one cylinder, two or more cylinders may be used simultaneously in the same way.

Or, instead of forming the rolls by either of the preceding methods, they may be formed by passing the clay between rollers, having suitable indentations or matrices on their surfaces.

A third mode of forming the roll, which may be sometimes adopted, consists in compressing the clay between plates, dies, or moulds, suitably engraved or sunk for the purpose; or by first compressing the moulds firmly together, and then forcing the clay into them, and throughout their entire length.

Boring the Roll.—For this purpose the patentee uses a mandril, or series of wires or mandrils, arranged in the following manner:—Into a rod, fitted to and extending from side to side of the clay vessel, are inserted the wires or mandrils. Each of these wires is exactly opposite some one of the apertures of the plates before described, and extends some little distance through the exact centre of the apertures, so that the clay, in being forced out through the apertures, must pass over the wires and leave the rolls hollow.

Wiring the Roll.— The apparatus for this purpose consists of a frame in which are a number of grooves corresponding to the number of rolls to be produced at once from the machine. Into each of these grooves is laid an ordinary wire, such as is used for moulding pipes, but having in addition a slide or runner, through which the wire passes freely, and which is intended to keep the wire parallel and opposite the mandrils of the machine. When these wires are laid on the frame, the frame is placed at the end of the machine, when the points of the wires come in contact, or nearly so, with the ends of the wires or mandrils, so that when the rolls begin to pass over the mandrils they are received upon the wires in the frame, and the runners recede as the roll advances up the wire. The rolls are then moulded in the usual manner, and the wires withdrawn. It is proper, however, to observe that these wires will act precisely the same if the roll be produced from the machine solid, instead of being first bored by the mandril.

Another method of wiring the roll consists of laying a roll in a suitable mould, and forcing the wire throughout the entire length of the roll, which may be done with great

accuracy by means of guides. The patentee prefers, in this case, to use wires made of tempered steel which are not liable to bend.

Firing the Pipes.—When the pipes are ready for firing they are to be placed upon earthenware frames previously to putting them into the kiln, and the frame itself, with the pipes upon it, then put into the kiln. By this means, the kiln is more speedily filled and sooner emptied, than by the ordinary process. These frames are each of the form of a segment of a circle, and of various sizes, so as to fit the various circles or ledges in the kiln.

First. The making of bricks with undercut grooves on either or both of their faces.

Second. The employment in the manufacture of tobacco pipes, and in the process of preparing the clay of rollers revolving in opposite directions at different rates of speed.

Third. The forming the roll in the said manufacture by the three different modes or processes hereinbefore described; namely, either by forcing the clay through apertures which are made by springs or other equivalent mechanical means, to expand according to the varying thicknesses required for the different parts of the pipe, or by passing the clay between rollers having indentations or matrices on their surfaces; or by compressing the clay between flat dies or moulds; and whatever may be the sort of machinery or means employed in each of these processes to force or compress the clay between the moulding or forcing surfaces.

Fourth. The employment in the said manufacture of pipe moulds, constructed as before described.

Fifth. The employment in the said manufacture of wires or mandrils to bore the roll in connection with the first of the modes of forming the roll.

Sixth. The method of wiring the roll in the said manufacture, by receiving the same as it passes from the machines, by which it is formed upon wires, having slides or runners, which recede by the pressure of the clay.

Seventh. The employment, in the ordinary method of wiring the rolls, of guides to direct and regulate the insertion of the wire.

Eighth. The employment in the said manufacture of moveable earthenware frames for holding the pipes when ready for firing, introducing them into the kiln, and withdrawing them from the same.

Ninth. The application of the said improvements in the manufacture of tobacco-pipes to the manufacture of all such other articles employed in smoking made from plastic materials, to which the same may, in whole or in part, be applicable.

NATHANIEL BEARDMORE, 13, Great College-street, Westminster. *For certain improvements in founding and constructing walls, piers, and breakwaters; parts of which improvements are applicable to other structures.* Patent dated 3rd July, 1848.

These improvements consist in constructing the foundations of submarine structures generally, of a combination of wrought-iron plates formed into caissoons, and "*filling-up.*" The bottom, sides, and ends of the caissoon are composed of boiler plate-iron, riveted and otherwise, held firmly together by means of angle or T iron, and further stayed by knees and ribs. The bottom of the caissoon is divided into cellular compartments, by means of vertical iron plates, made fast to the bottom, in a longitudinal direction. The tops of the vertical plates are bent downward, and serve to retain the concrete or "filling-up" in the cells. Walls of brickwork, or other suitable material, are built up against the inside surfaces of the sides and ends of the caissoon, which is divided longitudinally by a partition of brickwork, or other suitable materials, and also crossways into water-tight compartments, by bulkheads built in the same manner and of the same substance. When the caissoon has been so far completed, it is floated into the desired position, and then sunk, either by admitting water into the interior vacant compartments, or by filling them with stones or other sufficiently weighty materials. The caissoon may then be faced with masonry in the ordinary way, and constructed in lengths of from 300 to 800 feet.

The patentee proposes to apply his invention to form the flooring and foundations of warehouses and other similar buildings. The floor is composed of iron plates, riveted together, and made fast to the sides of the building, and the compartments filled up with concrete. *Claims.*—

Founding walls, piers, or breakwaters upon a base consisting of wrought-iron plates, arranged and combined with "filling-up."

Constructing walls, piers, or breakwaters of caissoons, having bottoms, ends, and double sides, made of wrought-iron plates, with a portion of the structure built therein, so as to form, when sunk, a portion of the paramount structure itself.

Constructing the floors and foundations of buildings of wrought-iron plates, arranged and combined with "filling-up."

ELIZABETH DAKIN, St. Paul's-churchyard, widow. *For improvements in cleaning and roasting coffee, in the apparatus and machinery to be used therein, and also in the apparatus for making infusions and decoctions of coffee.* Patent dated 3rd July, 1848. *Claims.*—

The employment in the cleansing and roasting of coffee of vessels composed of or lined with gold, silver, platinum, or any alloy of these metals.

The application and adaptation to cleaning and roasting of coffee, of vessels composed of or lined with gold, silver, platinum, or any alloy of these metals.

The employment of a railway and traversing carriage to support the roasting vessel in the furnace, and to facilitate its withdrawal.

The employment of a flexible bag or purse in the coffee biggen, which, by screwing, twisting, or pressing, allows the decoction to pass out.

The employment of a perforated vessel and piston for expressing the decoction, in lieu of the preceding.

Richard Clark, Strand, lamp manufacturer. *For certain improvements in gas-burners, and in candle-lamps and other lamps.* Patent dated June 26, 1848; specification enrolled December 26, 1848.

Claims.—The several plans described, or any mere modification thereof, for entirely enclosing gas-burners within a glass vessel or chamber, so as to protect the flame from external draught, and cause the air which supports the combustion of the gas to be thoroughly warmed or heated before it arrives at the burner; also so ornamenting the glass chamber, in order that the metallic part of the burner may be hidden from view as much as possible, yet, at the same time, the passage of the light may not be impeded or its quantity diminished.

Secondly. The various improvements in gas-burners described, and also the improved modes of supporting the chimney and glass shades, and preventing them from becoming accidentally displaced.

Thirdly. The method of constructing burners, whereby any irregularity or want of uniformity in the pressure of gas from the mains is prevented from injuriously affecting the flame.

Fourthly. Dividing the spring of a candle lamp into two parts, and also adapting the tubular or other piston to the upper part of the spring—one of the objects of both these improvements being to facilitate the placing the spring in the candle tube, after it has been removed for some necessary purpose. Another object of dividing the spring into two parts, and separating them by discs, is to prevent the melted tallow or grease from getting into and clogging up the lower portion of the spring, which, therefore, need never be removed from the tube.

Fifthly. Constructing night lamps with a curved or hemispherical bottom, so as to cause the melted tallow or grease to drain down to the lowest point, and be consumed.

Sixthly. Constructing oil or other lamps in the manner described, or any mere modifications thereof, whereby the flame is or may be perfectly protected from external draughts, and yet be abundantly supplied with air to support combustion; also the manner of adapting an oil cup to the lower part of the lamp, for the purpose of receiving any overflow: and also the improved mode of constructing the stuffing-box, as before described, as well as the method of attaching glass handles to spindles for any of the purposes to which such handles may be applicable.

Seventhly Constructing pressure lamps with a strainer or percolating surface, adapted to or made in the lower end of the supply pipe, for the purpose of preventing any impurities from passing into the interior of the lamp, and clogging it up; also making a valve or valves in the piston or plunger of pressure lamps, for the purpose of allowing any air that may have accidentally got under the piston or plunger to escape therefrom; and the method of regulating the supply of oil to the burner, by means of a small plug or screw, by screwing or unscrewing which the capacity of the passage may be regulated at pleasure; and further, constructing pressure and other lamps with short wicks, for the purpose above set forth; also a support.

Eighthly. Regulating the supply of oil to railway lamps by means of a plunger or spindle, whereby the flow of oil may be regulated to a nicety, or stopped altogether, if required.

Ninthly. Making lamps or lanterns with reflectors which may with facility be detached from them or adapted thereto when required; and the magnifying, by means of a lens, the rays of light upon the focus of a reflector; and

Lastly. Counterbalancing chandeliers by means of weights inclosed in the tubing which forms the channel of communication from the main to the burners in the case of gas lamps, and which only serve to support the chandelier when oil is used.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Gilmour Wilson, of Port Dundas, Glasgow, engineer, for improvements in the formation of moulds and cores of moulds for casting iron and other substances. December 30; six months.

William Knapton, of York, ironfounder, for certain improvements in the mode of manufacturing gasometers or gasholders. January 3; six months.

William Thomas, of Cheapside, London, merchant, for improvements in the manufacture of window blinds. (Being a communication.) January 4; six months.

David Yoolow Stewart, of Montrose, Scotland, ironfounder, for improvements in the manufacture of moulds and cores for casting iron and other substances. January 4; six months.

Henry Francis, of Chelsea, Middlesex, engineer, for improvements in sawing and cutting wood. January 4; six months.

Robert Munn, of Stack Head Mill, near Rochdale, Lancaster, cotton spinner, for certain improvements in looms and apparatus connected with looms for weaving various descriptions of textile fabrics. January 4; six months.

William Crofton Moat, of Upper Berkeley-street, Middlesex, surgeon, for improvements in engines to be worked by steam, air, or gas. January 4; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Designs.
Dec. 29	1714	George Forester and Co.	Liverpool	Hydrant, or slide valve, for water pipes, fire hose, and other purposes.
"	1715	Towns and Packer	Oxford-street	Improvements in the action of pianofortes.
"	1716	John Bryce	Glasgow	Hydrostatic pressure regulator.
30	1717	Julius Singer	Princes-street, Leicester-square,	The portable wrapper vest.
1849 Jan. 1	1718	Isaac Moses (trading under the firm of E. Moses and Son)	Minories	Duplex waistcoat.
"	1719	Charles Carr Williams,	Railway Carriage Works, Goswell-street	Balance frame for door glasses, or shutters for railway and common road carriages.
3	1720	John Greenwood, Jun.	Mold Green, Huddersfield	Rack and pinion shuttle.

NOTICES TO CORRESPONDENTS.

The Supplement to the last Volume containing Title, Index, &c., is now published, and may be had gratis *of the Publisher.*

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co. Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1327.] SATURDAY, JANUARY 13, 1849. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

MESSRS. BARTON AND CLOWES' UNIVERSAL GAS METER.

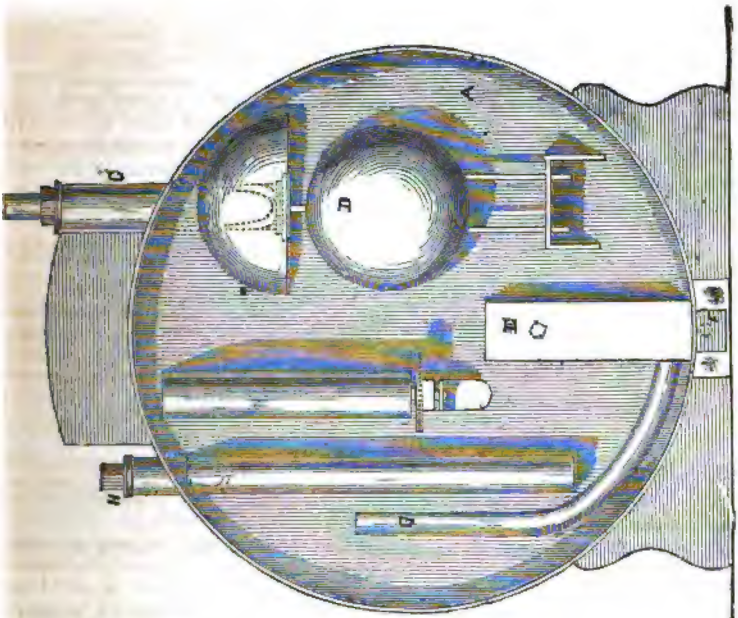


Fig. 2.

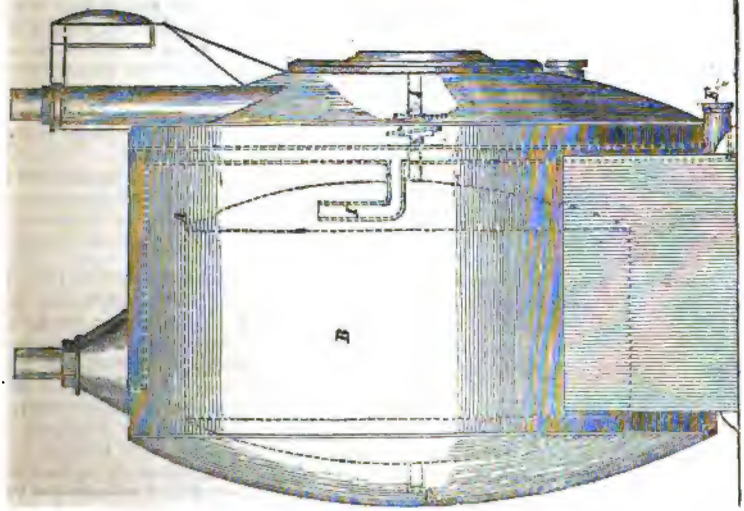


Fig. 1.

C

THE UNIVERSAL GAS-METER.

[Registered under the Act for the Protection of Articles of Utility. Edward George Barton, of Lambeth, Gas Apparatus Maker, and Joseph Clowes, of Camberwell, Esq., Proprietor.]

Fig. 1 is an end elevation of this meter, and fig. 2 an inside view of the front plate, with the parts connected to it. A is the case; B, the wheel or drum by which the gas is measured; C, the pipe for the admission of gas into the meter; D, a float-valve on the pipe, B, which closes when the level of the water gets too low; E, the pipe for the escape of the gas from the drum, which pipe terminates in another pipe, F, by which the gas is conveyed to the burners; G is the side piece or syphon, by which the water level is regulated: H, the feed-pipe for supplying the water to the meter; I, the stuffing-pipe for the spindle, by which the motion of the drum is communicated to the index-work.

The whole of the small work shown in fig. 3 is enclosed in the case along with the drum, and the use of a separate chamber for that purpose is dispensed with.

The following important advantages result from this arrangement:

1st. That there can be no variation in the water level, as in meters having two chambers (one for the drum and another for the "small work,") from the difference of the pressure of the gas in which, inaccuracy of measurement is unavoidable.

And, 2nd. That no gas can be passed through the meter without passing through the drum, and, consequently becoming measured.

MR. WOODCROFT'S SKETCH OF THE HISTORY OF STEAM NAVIGATION. (SECOND NOTICE.)

To the enterpise of *Henry Bell*, of Helensburgh on the Clyde, we are indebted for the construction of the first passenger steam vessel (the *Comet*) which actually plied for hire on British waters. Bell himself claimed for this vessel the credit of being "the first steam boat built in Europe that answered the end," and as being at the time he advanced this claim (1816) "upon the best and simplest method of any of them"; but as Mr. Woodcroft justly observes:

> No valid claim can be established in favour of Mr. Bell as the inventor of the present system of steam navigation, or for any improvements beyond those of which he had acquired a knowledge from the experiments of Messrs. Miller, Taylor, and Symington. In fact, Symington's boat, the *Charlotte Dundas*, which had been frequently inspected by both Bell and Fulton, was superior in its mechanical arrangements to either Fulton's *Clermont* or Bell's *Comet*, as may be readily seen by inspection of the drawings. p. 82.

Ocean steam navigation next occupies Mr. Woodcroft's pen; but strange to say, the name which should have figured *first* on this part of his historical scroll, namely, that of NAPIER — is not once mentioned. Mr. W. will perceive at once the necessity of supplying in his next edition this glaring omission.

The only ocean steamer which has hitherto made the entire circuit of the globe, is, it appears, H.M. steam sloop, *Driver*.

She left England on the 16th March, 1842, under Commander Harmer, who died in China. Captain Hayes then took the command of her, and brought her home.

After leaving England, she touched at the following places: — The Cape of Good Hope, the Mauritius, Singapore, and Hong Kong. Between the 5th of August, 1842, and the 9th of June, 1845, she was employed in making frequent passages from port to port in China; from China she went to Borneo, Trincomalee, and Bombay; she then returned to Trincomalee, and proceeded from there to Singapore, Manilla, and Hong Kong.

On the 27th September, 1845, she sailed from Hong Kong, attempting the eastern *route* to New Zealand; but when she arrived to the eastward of the Bashee Islands, she encountered a typhoon, lost all her sails, sprung a leak in two of her boilers, and sailing down the China seas, was compelled to bear up for Singapore, and repair defects. She then steamed through the Java Seas to Sourabaya, and was subsequently compelled to anchor at Pyon, in the Islands of Linnbock, to repair boilers. From

Pyen she proceeded to Swan River, thence to Hobart Town, Sydney, and to the Bay of Islands in New Zealand, where she was employed in making passages from port to port, from the 19th of January, 1846, to the 18th of January, 1847. On the 28th of that month she left New Zealand, and arrived at Rio in 51½ days; and from Rio she reached England in 48 days. Owing to occasional want of fuel, leakage of boilers, and other causes, steam was not used throughout the whole of each of her voyages. She was longer in commission than any vessel since the peace, namely, five years and nine months, during which period she travelled 75,696 miles. p. 89.

The substitution of the *screw* for the *paddle-wheel* comes lastly under review. Mr. W. considers Captain Ericsson to be entitled to the honour of having been the first practical introducer of this system both in Great Britain and the United States.

Bramah, in 1785, patented a submerged propeller, on the principle of the sails of a windmill, or the blades of a smoke jack. William Littleton patented a screw propeller of three blades in 1794, and experimented with a copper screw so formed as described by Colonel Beaufoy. Edward Shorter also patented a screw propeller in 1800, and which was successfully tried by manual power to move vessels of war in 1802. Mr. Samuel Brown had a boat expressly built for being propelled by a gas vacuum engine (of which he was the inventor), made to drive a two-bladed submerged propeller in the bow of the boat, by which a speed of from six to seven miles an hour was obtained. Yet, notwithstanding these meritorious efforts to accomplish the successful introduction of the use of the screw propeller, this instrument did not come into practical use until a very recent period, when its merits as a propeller were for the first time fully demonstrated and carried into successful operation by Captain John Ericsson, C.E., in strict accordance with a peculiar arrangement of screw propellers patented by him on the 13th July, 1836.

Captain Ericsson is a native of Sweden, and held a commission in the Swedish army; but his taste for mechanics was such as to induce him to leave his native country and establish himself in London, in partnership with the well-known establishment of Messrs. Braithwaite, in which he became a partner under the firm of Braithwaites and Ericsson.

Prior to the construction of his first vessel, he made some experiments with a model boat which was propelled by means of a screw, in a circular bath in London. The model boat was fitted with a small engine, supplied with steam by a pipe leading from a steam boiler over the centre of the bath, and descending to within a foot of the water line where it was branched off by a swivel joint, and connected with the engine in the boat. Steam being admitted into this pipe, the engine in the boat was put in motion, and motion was thus communicated to the propeller. This model, though less than two feet long, performed its voyage about the basin at the rate of upwards of three miles an hour.

The following account, so far as it relates to the performance of the screw boat, the *Francis B. Ogden*, is extracted from "Weale's Papers on Engineering," vol. iii., part v., pages 1—7, under the head, "Steam Navigation."

"So much has been stated as to the success and efficiency of steam power, as applied to navigation and for war purposes in the United States, that we have added to our papers the following lecture, as written and published in America. We prefer giving the precise words, with the exception of a very short note in a subsequent page. We take leave to say, that the objects of science are best carried out by reference to such matters only as shall tend to illustrate the point in discussion.

"A Lecture on the late Improvements in Steam Navigation and the Arts of Naval Warfare, with a brief Notice of Ericsson's Caloric Engine, delivered before the Boston Lyceum, in December, 1843, by John O. Sargent.

"The next step in the invention was the construction of a wooden boat, 40 feet long, 8 feet beam, 3 feet draught of water, with two propellers, each of 5 feet 3 inches diameter.

"So successful was this experiment, that when steam was turned on the first time, the boat at first moved at a speed of upwards of ten miles an hour, without a single alteration being requisite in her machinery. Not only did the boat attain this considerable speed, but its power to tow larger vessels was found to be so great, that schooners of 140 tons burthen were propelled by it at the rate of seven miles an hour; and the American packet ship, *Toronto*, under the command of Captain Griswold, was towed in the River Thames by this minature steamer, at the rate of more than five English miles an hour through the water. The engineers of London regarded the experiment with silent neglect; and the subject, when laid before the Lords of the British Admiralty, failed to attract any favourable notice from that august body. Perceiving its peculiar and

admirable fitness for ships of war, Ericsson was confident that their lordships would at once order the construction of a war steamer on the new principle. He invited them, therefore, to take an excursion in tow of his experimental boat. Accordingly the gorgeous and gilt Admiralty barge was ordered up to Somerset-house, and the little steamer was lashed alongside.

"The barge contained Sir Charles Adams, senior Lord of the Admiralty; Sir William Symonds, Surveyor of the British Navy; Sir Edward Parry, the celebrated commander of the second North Pole expedition; Captain Beaufort, hydrographer, and others of scientific and naval distinction.

"In the anticipation of a severe scrutiny from so distinguished a personage as the chief constructor of the British Navy, the inventor had carefully prepared plans of his new mode of propulsion, which were spread on the damask cloth of the magnificent barge. To his utter astonishment, as we may well imagine, this scientific gentleman did not appear to take the slightest interest in his explanations. On the contrary, with those expressive shrugs of the shoulder and shakes of the head, which convey so much to the bystander without absolutely committing the actor—with an occasional sly, mysterious, undertone remark to his colleagues —he indicated very plainly that though his humanity would not permit him to give a worthy man cause for so much unhappiness, and yet that "he could, an' if he would," demonstrate by a single word the utter futility of the whole invention.

"Meanwhile the little steamer, with her precious charge, proceeded at a steady progress of ten miles an hour, through the arches of the lofty Southwark and London Bridges, towards Limehouse, and the steam engine manufactory of Messrs. Seaward. Their lordships having landed and inspected the huge piles of ill-shaped cast-iron, misdenominated marine engines, intended for some of His Majesty's steamers—with a look at their favourite propelling apparatus, the Morgan paddle-wheel, (a very admirable instrument by-the-bye,) they re-embarked, and were safely returned to Somerset-house, by the disregarded, noiseless, and unseen propeller of the new steamer.

"On parting, Sir Charles Adams, with a sympathising air, shook the inventor cordially by the hand, and thanked him for the trouble he had been at in showing him and his friends this interesting experiment; adding, that he feared he had put himself to too great an expense and trouble on this occasion. Notwithstanding this somewhat ominous finale of the day's excursion, Ericsson felt confident that their lordships could not fail to perceive the great importance of the invention. To his surprise, however, a few days afterwards, a friend put into his hands a letter written by Captain Beaufort, at the suggestion, probably, of the Lords of the Admiralty, in which that gentleman, who had witnessed the experiment, expressed regret to state that their lordships had certainly been very much disappointed at its result. The reason for the disappointment was altogether inexplicable to the inventor; for the speed attained at this trial far exceeded anything that had ever been accomplished by any paddle-wheel steamer on so small a scale. An accident soon relieved his astonishment, and explained the mysterious givings-out of Sir William Symonds, alluded to in our notice of the excursion. The subject having been started at a dinner-table, where a friend of Ericsson was present, Sir William ingeniously and ingenuously remarked, that, "Even if the propeller had the power of propelling a vessel, it would be found altogether useless in practice, because the power being applied in the stern, it would be absolutely impossible to make the vessel steer." It may not be obvious to every one how our naval philosopher derived his conclusion from his premises; but his hearers doubtless readily acquiesced in his oracular proposition, and were much amused at the idea of undertaking to steer a vessel when the power was applied in her stern.

"But we may well excuse the Lords of the British Admiralty for exhibiting no interest in the invention, when we reflect that the engineering corps of the empire were arrayed in opposition to it; alleging that it was constructed upon erroneous principles, and full of practical defects, and regarding its failure as too certain to authorise any speculations even of its success. The plan was specially submitted to many distinguished engineers, and was publicly discussed in the scientific journals; and there was no one but the inventor who refused to acquiesce in the truth of the numerous demonstrations, proving the vast loss of mechanical power which must attend this proposed substitute for the old-fashioned paddle-wheel.

"While opposed by such a powerful array of English scientific wisdom, the inventor had the satisfaction of submitting his plan to a citizen of the New World, who was able to understand its philosophy and appreciate its importance. I allude to a gentleman well known to many who have enjoyed his liberal hospitality in a foreign land, Mr. Francis B. Ogden, a native of New Jersey, for many years Consul of the United States at Liverpool, and in that posi-

tion reflecting the highest credit on the American name and character. Though not an engineer by profession, Mr. Ogden had been distinguished for his eminent attainments in the mechanical sciences, and is entitled to the honour of having first applied the important principles of the expansive power of steam, and of having originated the idea of employing right angular cranks in marine engines.

"His practical experience and long study of the subject,—for he was the first to stem the waters of the Ohio and the Mississippi, and the first to navigate the ocean by the power of steam alone,—enabled him at once to perceive the truth of the inventor's demonstrations. And not only did he admit their truth, but he also joined Captain Ericsson in constructing the first experimental boat to which I have alluded, and which the inventor launched into the Thames with the name of the *Francis B. Ogden*, as a token of respect for his transatlantic friend. Other circumstances soon occurred which consoled the inventor for his disappointment in the rejection of the propeller by the Lords of the British Admiralty.

"The subject had been brought to the notice of an officer of the navy of the United States, who was at that time on a visit to London, and who was induced to accompany the inventor in one of his experimental excursions on the Thames. I allude to Capt. Robert F. Stockton, who is entitled to the credit of being the first naval officer who heard, understood, and dared to act upon the suggestions of Ericsson, as to the application of the propeller to ships of war. At the first glance, he saw the bearings of the invention, and his acute judgment enabled him at once to predict that it was destined to work a revolution in naval warfare.

"To those who are not acquainted with the character of Captain Stockton, the great rapidity of his perception, his self-reliance, and the energy with which he prosecutes his purposes, it may excite some surprise to learn that, after making a single trip in the experimental steam-boat from London Bridge to Greenwich, he ordered the inventor to build for him forthwith two iron boats for the United States, with steam machinery and propeller on the plan of this rejected invention. 'I do not want,' said Captain Stockton, 'the opinions of your scientific men; what I have seen this day satisfies me.'

"It is due to Captain Stockton to state, that his whole course in regard to this invention, and the introduction of it into this country (America), has been in accordance with the spirit of this remark.

"At a dinner given on this occasion at Greenwich, Captain Stockton, in his happy style, made several predictions and promises in respect to the new invention, all of which have since been realized. To the inventor he said, in words of no unmeaning compliment, 'We'll make your name ring on the Delaware, as soon as we get the propeller there!'

"The *Princeton* (war steamer) was launched into the Delaware, and the Ericsson steamboat line is now carrying nearly the whole of the freight between Philadelphia and Baltimore; and Captain Ericsson's several iron propeller boats may be seen every day on the Delaware, carrying the rich mineral products of Pennsylvania to the east.

"But not only did Captain Stockton order, on his own account, the two iron boats to which I have referred; he at once brought the subject before the Government of the United States, and caused numerous plans and models to be made at his own expense, explaining the peculiar fitness of the new invention for ships of war. So completely persuaded was he of its great importance in this aspect, and so determined that his views should be carried out, that he boldly assured the inventor that the Government of the United States would test the propeller on a large scale; and so confident was Ericsson that the perseverance and energy of Captain Stockton would sooner or later accomplish what he promised, that he at once abandoned his professional engagements in England, and set out for the United States.

"Circumstances delayed for some two years the execution of their plan. With the change of the federal administration, Capt. Stockton was first able to obtain a favourable hearing; and, under the auspices of the present administration, the experiment of the *Princeton* has been made, and has been successful.

"It is due to the inventor to mention that the propeller, as successfully applied in the *Princeton*, is the same precisely in construction with that of the *Francis B. Ogden*, not merely in theory, but in its minute practical details.

"There is now a propeller in the Phœnix Foundry, in New York, brought over by Captain Ericsson, in the *British Queen*, in 1839, which, in all its essential parts, is a fac-simile of that in the *Francis B. Ogden*, and of that in the *Princeton*. p. 89—96.

We have several exceptions to take to the statements contained in the preceding extract:—1. Captain Ericsson never was "in partnership with the well-known establishment of Messrs. Braithwaite," nor did he become a partner," under the firm of *Braith-*

waites and Ericsson." There never was any such firm as *Braithwaites and Ericsson;* nor was Captain Ericsson a partner in any shape or form in the establishment referred to. 2. The "huge piles of ill-shaped cast-iron, *mis-denominated marine-engines,*" inspected at the "engine manufactory of the Messrs. Seaward" must have been some of the direct action engines on the *Gorgon* plan, first introduced by that firm, and which were *the very best marine engines then in use.* 3. It is not true that "the engineering corps of the empire were arrayed in opposition" to Captain Ericsson's system of screw propulsion, and that though "submitted to many distinguished engineers, and *publicly discussed in the scientific journals,*" there was "no one but the inventor," &c. Mr. Woodcroft supplies elsewhere a sufficient answer to this charge:—

Notwithstanding the unfavourable and discouraging result of Captain Ericsson's attempts to obtain for his discovery the patronage of the Lords of the Admiralty, it should in justice be stated that *few inventions ever elicited such* APPROVING NOTICES *from the press;* accounts of the several experiments appeared in the *Times*, and other public journals; also in the *Civil Engineers and Architects' Journal*, the *London Journal of Arts and Sciences*, the *London Mechanics' Magazine*, and other similar publications. p. 98.

4. Captain Stockton, however well he may have behaved in the first instance towards Captain Ericsson, betrayed him in the end most scandalously—so much so as to make it necessary for Captain Ericsson to complain of his conduct to the American Congress; from which, however, he has not as yet (to the best of our knowledge) obtained any redress. The Captain of "the happy style" did help to make the name of Ericsson "ring on the Delaware," but always with a watchful eye, or as his own countrymen would not scruple to call it, "a villanous squint," towards his own private and personal advantage.

But all these exceptions, notwithstanding, we cordially subscribe to the general conclusion at which Mr. Woodcroft arrives, that Captain Ericsson "accomplished for the screw propeller in America and in England what Fulton did for the paddle-wheel in the former, and Bell in the latter country—namely, its *practical introduction.*" p. 102.

Of the subsequent fortunes of the *Robert F. Stockton*, and progress of screw propelling in America, we have the following interesting account:—

The *Robert F. Stockton* left England for the United States in the beginning of April, 1839, under the command of Captain Crane, of the American merchant service, a most intrepid sailor. His crew consisted of four men and a boy. Captain Crane made a four days' passage, under sail only; and for his daring in thus crossing the Atlantic in this small vessel, he was presented with the freedom of the City of New York.

The machinery was so arranged that either one or two propellers might be used; and in the year 1838 she was worked with a single propeller in the River Thames.

In 1840, Captain Stockton sold this vessel to the Delaware and Rariton Canal Company, permission having first been obtained, by special act of Congress, to run her in American waters, though of English bottom—her name being at the same time changed to that of *New Jersey*. From that period to the present she has been in constant operation, as a steam tug, on the Rivers Delaware and Schuylkill, with scarcely any cessation during the winter months, as she is capable of towing through the drift ice when paddle-wheel steamers are of little use.

The *New Jersey* was the first screw-propelled vessel practically used in America, numerous experiments with the screw having been previously made without success. The value and importance of the screw as a propeller having been thus clearly demonstrated, one hundred and fifty other vessels have since been so fitted and propelled in America, most of which are now in active operation in the carrying trade, returning large profits to their owners, particularly those employed on the great North American lakes.

As a further proof of the practical value of this invention, it may be mentioned, that in the spring of the present year (1848), 13 screw-propelled vessels were employed on Lake Ontario, and only nine paddle-wheel steamers.

This remarkable instrument has completed the link of internal steam communication of the United States, by uniting Lake Ontario and the St. Lawrence with the immense upper lakes through the Welland Canal, and also the Chesapeak Bay and the southern waters with the River Delaware.

and the northern waters, through the Chesapeak and Delaware Canal.

It may also be mentioned, as an interesting historical fact, that the introduction of the first screw steamer, the *Ericsson*, between Philadelphia and Baltimore, by the inland route, *viâ* Chesapeak and Delaware Canal, completely annihilated, as a profitable speculation, one of the greatest works in the country, the Philadelphia and Baltimore Railway. To compete with this single vessel, built at an expense of a few thousand pounds, a Company which had expended millions was compelled to reduce its fares one-half! and the state of Delaware, through which the canal passes, with a view of protecting the interests of the Company, imposed a prohibitory toll on passengers going by the screw-propeller line. The freight business, however, was lost to the Company for ever.

Prior to Captain Ericsson leaving this country for America, he had built for Mr. John Thomas Woodhouse an iron screw propeller vessel, to run as a passenger boat on the Ashby-de-la-Zouch Canal. She was named the *Enterprise*. Her length is about 70 feet, beam 7 feet, and her engines about 14 horses power; her speed, where the water is wide and deep, is from 9 to 10 miles per hour. She was delivered and commenced to run on that canal in the middle of the month of August, 1839, and having run during a season without being profitable, she was then used as a steam tug, on the Trent and Mersey, for a certain coal traffic, with great success. The introduction of railways has, however, rendered her valueless for that object, and she is now for sale. p. 100—102.

The remainder of Mr. Woodcroft's volume is chiefly occupied with "the encreasing pitch screw propeller" of his own invention, of the distinguishing properties of which this is his account:

The form differs essentially from either a plane or a screw, the blade being made to vary in its angle from the axis throughout the whole length of such propeller, no section of it, *however short*, having upon it either a plane surface or the surface of a screw.

* * * *

It is the only propelling instrument of any description which has the peculiar and inherent property of acting with an increased impulse against the water from the leading part, first taking its action against the water to the end, however long or short such propeller may be upon its axis. p. 109.

Mr. Woodcroft relates how various experiments were made with this propeller, all showing that it gave results superior to those of "any other form of submerged propeller, when tried under similar circumstances"—how it was tried in the *Archimedes*, the *Napoleon* (French post-office steamer), and Her Majesty's steam sloop *Rattler*—how the term of his patent for it was renewed for five years by the Privy Council, after ample testimony in its favour by a number of most unexceptionable witnesses, and a warm eulogium by the Privy Council's guide in scientific matters, Lord Brougham—and how, after all, "*the only* increasing pitch screw in the Royal Navy, is the one made by the author for the *Rattler*."

Shall we tell Mr. Woodcroft, without offence, the real cause of this (apparently) inexplicable result? He has freely used the language of truth and sincerity towards others, and will not, we hope, object to a little of the same sort of treatment towards himself. The "increasing pitch" is thought little of, for this all-sufficient reason, that *within the limits* to which it can be applied in screw propelling, it is no better than the screw of the *uniform pitch* (as claimed by Lowe.) An increase of pitch in the threads of a screw of *ten or twelve feet* in length forwards, would, to a certainty, be productive of great advantage; but when the length of that screw is reduced a foot or a couple of feet (the usual limits of size for screw propellers), the difference between it and a screw of uniform pitch becomes as imperceptible to the eye as it is untraceable in the log-book. Mr. Woodcroft says, that "no section of it, *however short*, has upon it either a plane surface or the surface of a screw." That may be, and yet nothing worth while be gained by the difference. Let us test this proposition by his own statements of its performances. A "4-bladed Archimedean or true screw" was tried in the *Rattler* on the 18th March, 1844, and an increasing pitch screw on Mr. Woodcroft's plan was tried on the same vessel on the 13th April following. The results are stated to have been as follows:—

		Horses power exerted.	Stroke of engine per minute.	Revolutions of screw per minute.	Knots run per hour.
1844, 18 March.	Smith's Uniform Pitch Screw..	459·	26·28	104·34	8·18
	Woodcroft's Increasing Pitch Screw................	428·76	24·152	95·99	8·159
	Results in favour of Woodcroft's Screw		2·128	8·35	·921
	Results in favour of Smith's Screw				

On a subsequent occasion (5th July, 1848), thirteen different modifications of screw propellers were tried on board the *Minx*, when the result was in favour of Mr. Woodcroft's screw propeller (with a slight alteration suggested by Mr. Atherton). "Woodcroft's screw propelled the *Minx* at the rate of nine knots per hour, and when at its greatest velocity, the engines performed about three revolutions more per minute than with any of the other screws." p. 119.

The supposed gain in both these sets of experiments is a great deal too small to be worth insisting upon, and is just as likely to have been the result of incorrect observation or of accidental circumstances, as the imperceptible difference in pitch. It will be observed, besides, that there are two opposite reasons given for that supposed gain, each negativing the other, and so excluding the possibility of placing any reliance in either. In the first set of experiments, the engines are stated to have performed with Woodcroft's increasing pitch screw *fewer* revolutions per minute than the uniform pitch screw, but to have produced a greater rate of speed; while in the second, the increase in speed is represented as arising from the engines having "performed about three revolutions per minute *more* than with any of the other screws." It is, further, not undeserving of notice, that the uniform pitch screw employed in the first set of experiments, was a "Smith's 4-bladed Archimedean;" whereas experience has shown that the form of this propeller, which gives the greatest effect, is that with the two half blades.

Lord Brougham's reasons for his eulogium are amusing:

"It appears, to my mind, that there is a clear step made in the progress of steam navigation, and in the construction of that very useful implement in steam navigation, 'the screw,' for the purpose of propulsion. The step made is as to the increase of velocity of the parts of the propeller, and its overtaking the wave, and not coming to be of equal velocity with the wave; and that is accomplished by a very refined and ingenious contrivance; and—speaking *as a scientific man* merely—an original one: *I mean substituting for a rectilineal screw wound round the cylinder, a curvilineal screw wound round the cylinder.* I am of opinion, *speaking upon scientific principles, that these are ingenious and important novelties in this matter.* It is introducing *a new mathematical principle, as well as a new mechanical principle*, and I hold it to be a highly important improvement." p. 118.

A "rectilineal screw!" What is that? Who ever saw one? Would it not be as sensible to talk of a rectilineal circle? And are not screws of all sorts necessarily "curvilineal?" Then, what is meant by the *screw* in both cases being "wound round the cylinder?" To us, "speaking on scientific principles," this seems very like rank

nonsense. The *screws* themselves are in neither case wound round a cylinder, or anything else. The lines forming them, indeed, are obtained by winding a thread round a model (or by a geometrical construction on the same principle), but that model is not always or necessarily "a cylinder." The real distinction between the Archimedean screw and Mr. Woodcroft's, is (to quote the words of his specification) simply this, that the "pitch or inclination of the spiral blade to the axis continually increases, whatever be the ratio or degree of such increase." And this is what the "scientific man" of the Privy Council—the oldest of "living mathematicians," as his lordship is fond of styling himself—calls "a new mathematical principle, as well as a new mechanical principle." Why, it is as old, nearly, as the oldest screw ever invented. Corkscrews with an increasing pitch have been in use from time immemorial. All Mr. Woodcroft's merit (*quoad hoc*) consists in applying this form of construction to the propulsion of ships. And had the screws of steamers been but of five or six times greater direct length than they actually are, he would doubtless have conferred much benefit on steam navigation by the ingenious suggestion.

But many people have taken licenses from Mr. Woodcroft, and many vessels have been constructed on his plan, which "answer perfectly." Lord Brougham laid great stress upon this. The question, however, is not whether Mr. Woodcroft's screw "answers perfectly" (which no one disputes), but whether it answers *better* than any other. And reasons may be conceived for taking a license to adopt his form of screw wholly distinct from any conviction of its superiority. There may be no mechanical advantage to be gained from the increasing pitch screw itself, and yet a most important pecuniary advantage to be derived from using it, under a license from Mr. Woodcroft, inasmuch as the user can plead that license in bar of any action for infringement which may be brought against him by the patentee of the uniform pitch screw, whose claims have so long occupied the attention of the Courts. Lowe's screw may or may not have been of his own invention, but it is, at all events, not Mr. Woodcroft's screw.

Mr. Woodcroft gives at the close of his work a "List of Patents, nearly all of which are for propelling vessels, and other documents relating to propelling vessels, which the author has prepared for publication." The list will be of use to persons interested in investigating the history of this branch of mechanics; but it is unfortunately overrun with clerical errors. We have noted upwards of thirty from memory alone. Mr. Woodcroft will, no doubt, see to the correction of these errors in his next edition, which, if great general merit is to be regarded, cannot fail to be very speedily called for.

HORÆ ALGEBRAICÆ. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

(Continued from p. 569, vol. xlix.)

XI. QUADRATIC EQUATIONS.

Availing myself of a privilege which I claimed in commencing these papers,* and which I have exercised in their progress, I shall devote a portion of the present article to a subject not as yet discussed in the *Horæ*. The following remarks on simultaneous quadratics are an extended application of principles already illustrated in my second series of *Notes on the Theory of Algebraic Equations*.†

Let

$$t=0,\ u=0,\ v=0,\ w=0,$$

be four simultaneous quadratics of the eighth order—that is to say, involving eight unknown quantities, x, y, z, &c. Then we are at liberty to assume that t is the sum of the squares of the unknowns added to the square of a known quantity; or, that

$$t=x^2+y^2+z^2+\ .\ +m^2,$$

where m is known. This reduction is affected by (first) transforming t into a sum of eight squares, and (then) substituting new unknowns for the given ones. The transformation may be performed by the Method of Vanishing Groups. To this preliminary remark it

* *Mech. Mag.*, vol. xlvii., p. 13.

† *Mech. Mag.*, vols. xlviii. and xlix.

may be added that, in the following investigations, a, b, c, d, ., &c., are *disposable* multipliers, which are introduced for the purpose of obtaining equations of forms more convenient than those of the given ones.

Problem. Solve the above four simultaneous quadratics of the eighth order.

First Solution. Whatever be the values of a, b, and c, so long as they are finite, we have, necessarily,

$$\left.\begin{array}{l} t+au=0\ldots.(1)\\ t+bv=0\ldots.(2)\\ u+cv=0\ldots.(3)\end{array}\right\}\ldots\ldots\ldots(a).$$

But

$$u=Ax^2+lx+n,$$
$$v=A'x^2+l'x+n',$$

where l, l', n, n', A, A$'$, are free from x. By means of the equations $l=0$, and $l'=0$, let y and z be eliminated from the three equations marked (a). Then the first power of x will disappear from those equations at the same time as y and z. For, (1) and (2) will be free from the first power of x, and, consequently, (3) will be so; since, in the latter equation, the coefficient of x is

$$l+cl',$$

which vanishes. Hence if a, b, and c be determined so as to cause x^2 to disappear from the respective equations (a) those three equations will be free from x, y, and z. Write them, when freed entirely from x, as follows:—

$$t'=0,\ u'=0,\ v'=0\ ;$$

then these last three equations are three simultaneous quadratics of the fifth order and admit of solution.* Solve them, and determine x so as to satisfy $w=0$. The given system of equations is now completely satisfied, as it might have been had $w=0$ been a cubic instead of a quadratic.

Second Solution. Form the equations

$$t+au+bv=0\ldots\ldots(4)$$
$$t+cu+dw=0\ldots\ldots(5)$$

which may be respectively written

$$Ax^2+By^2+Cx+Dy+E=0\ldots.(6)$$
$$A'x^2+B'y^2+C'x+D'y+E'=0..(7).$$

Make

$$C=0,\ D=0,\ C'=0,\ D'=0,$$

and by means of these last equations eliminate four of the unknowns from (6) and (7). Also let the equations

$$A=0,\ B=0\ ;\ A'=0,\ B'=0,$$

be satisfied; the first two by a and b, the last two by c and d. Then (6) and (7) will be free from x and y, and will involve two undetermined quantities; and

$$E=0,\ \text{and}\ E'=0,$$

can both be satisfied by means of a quadratic and a biquadratic. Let x and y be then determined by means of any two of the given quadratics, and the problem will be solved.

Third Solution. The last solution may be varied, so as to enable us to obtain x and y by means of a cubic and a linear equation, instead of a biquadratic and a quadratic. For, we may determine x and y from the equations

$$t+eu=0,\ \text{and}\ t+fv=0,$$

where e and f are such as to cause x^2 to vanish from the last two equations: in place of which we may write

$$Ax+B=0,\ A'x+B'=0,$$

and on eliminating x, we obtain

$$AB'-A'B=0,$$

a cubic in y; and x is determined by either of the equations preceding the last.

Perhaps "Colonel Silas Titus's Problem" is the earliest instance of a question involving three simultaneous quadratics. These quadratics are of the *third* order, but they are of such a form as to admit of being solved by means of a biquadratic. I have already alluded to this problem,* and it has occupied the attention of many distinguished mathematicians. It forms a sort of landmark in the history of science, and will not, I trust, be thought unworthy of some remarks in addition to those which I have already made† upon the subject. We are informed by Maseres‡ that

"This problem was proposed to Dr. Wallis in the year 1662, by Colonel Silas Titus, a gentleman of the bed-chamber to King Charles the Second, who was distinguished for his knowledge of the Mathematics, as well as of other branches of useful learning; and it had been originally proposed to Colonel Titus (as the Colonel informed Dr. Wallis) by Dr. John Pell, the famous Algebräist of that time."

* *Mech. Mag.*, vol. xlviii, p. 606; vol. xlix., pp. 10—11.

* *Mech. Mag.*, vol. xlix., p. 11.

† *Ibid.*

‡ "Tracts on the *Resolution of Affected Algebraick Equations*," &c. London, 1800. See p. 188 of those Tracts (*Art.* 2.)

The problem may be expressed algebraically as follows*:—Solve the equations

$$\left.\begin{array}{l} a^2+bc=16 \\ b^2+ac=17 \\ c^2+ab=18 \end{array}\right\}$$

In MASERES's *Tracts*, two solutions are given, one by WALLIS,† the other by FREND,‡ of both of which I proceed to give an account.

(1). In seeking the values of a, b, and c, in the above equations, WALLIS first shows "that each of them is different from the other two,"§ and he then goes on to prove that a is the least and c the greatest of those quantities.‖ His first step in the actual solution of the problem is to eliminate c;¶ this being done, b is next made to disappear, and a final equation in a is obtained** of the twelfth degree. It is to be observed, however, that no odd powers of a enter into this equation. The form of this equation is then changed (for the purpose of clearing it of fractions), by making $2a^2=e^2$. The equation in e is divisible by the square of $2l-e^2$ (where $l=16$), and is thus reduced to the eighth degree; and thence to a biquadratic by writing x in place of e^2.†† It is to be observed that

$$2l-e^2=2\ (l-a^2)=2bc.$$

I give these last relations because they may assist the reader in perceiving why the above-mentioned equation of the twelfth degree is capable of being depressed to one of the eighth. For myself, I have at present no time to examine minutely the operations involved in WALLIS's solution, whatever I may be able to do on another occasion.

(2). To the solution of FREND I have before alluded,‡‡ and I have pointed out the value and generality of the principle involved in it. It proceeds by making

$$b=xa, \text{ and, } c=ya,$$

and then eliminating a, and obtaining two quadratics in x and y, which give rise to a biquadratic involving only one of the two latter quantities. Thus we see that the problem is capable of complete symbolical solution.* By a precisely similar process, we might completely solve three given equations of the form

$$Au^2+Bv^2+Cw^2+Dvw+Euw+Fuv=G$$

as I have shown† in my Second Series of *Notes on the Theory of Algebraic Equations*, where, as I have before‡ observed, this generalization was, I think, first noticed.

(3). We next come to the solution of IVORY, which will be found at pp. 360—397 of the *Scriptores Logarithmici* of MASERES: IVORY subtracts the first of the three equations from the second, and the second from the third; and he writes the two results as follows§:—

$$(b-a)\ (b+a-c)=1,$$
$$(c-b)\ (c+b-a)=1;$$

he then makes

$$b-a=m, \text{ and, } c-b=n,$$

which gives

$$b+a-c=\frac{1}{m},$$
$$c+b-a=\frac{1}{n}.$$

He then finds a, b, and c in terms of m and n, and substitutes these values in the first of the given equations of the problem. The resulting equations, together with

$$2m+2n=\frac{1}{m}-\frac{1}{n},$$

is "sufficient to determine the unknown numbers m and n."‖ He, however, introduces two new quantities, x and y, determined by the relations $x=mn$ and $y=m^2$, and, after eliminating y from the calculations, and making $z=2x$, arrives at a final biquadratic in z.

IVORY regards his solution as "particularly remarkable on account of the simplicity of the result."¶ The solution itself is certainly very ingenious, but it has not the beauty of that of FREND —or rather it is not susceptible of the

* Tracts on the Resolution of Affected Algebraic Equations, pp. 188—189. The notation in the text differs, from that given by MASERES, only in the manner of writing the squares.
† *Ibid*, pp. 189—238. This solution was effected in June, 1662. *Ib*. p. 189.
‡ *Ibid*, pp. 240—275.
§ *Ibid*, pp. 190—191.
‖ *Vide Ib*., pp. 191—195.
¶ *Vide Ib*., pp. 196—197.
** *Ib*., p. 213.
†† *Vide Ib*., pp. 213—222.
‡‡ *Mech. Mag*., vol. xlix., p. 11.

* MASERES, *Tracts*, pp. 240—246. On this Problem see also pp. xli. to liv. of the Preface to the *Tracts*.
† *Mech. Mag*., vol. xlviii., p. 512, and see also, vol. xlix., p. 11.
‡ *Mech. Mag*., vol. xlix., p. 11.
§ *Scriptores Logarithmici*, p. 362. I have only substituted brackets for vincula.
‖ *Ibid*., p. 363.
¶ *Ibid*, p. 361. And on IVORY's solution see further pp. xxxiv. to xxxvi. of the Preface to the *Scriptores Logarithmici*.

simple form which the solution of FREND may be made to take. And, as observed by Mr. WHITLEY*, "it is adapted only to Colonel Titus's numbers," or perhaps to the case when the three given numbers of the Problem are of the forms $p, p+1$, and $p+2$, or, perhaps, $p, p+q$, and $p+2q$.

(4). The solutions of Mr. WHITLEY, Mr. SETTLE, and Mr. RYLEY are the same in principle as that of FREND. These solutions (or rather, the two first, and an intimation respecting the last) will be found at pp. 120—121 of No. II. of SWALE's *Liverpool Apollonius.* They are given in answer to a problem proposed at pp. 105—6 of No. I. of that work. At pp. 127—128 of the same number the reader will find a method of solving the problem by approximation, from the pen of Mr. WHITLEY.

(5). Another solution has been given by Professor DAVIES at pp. 272—3 of his *Solutions, &c., to Dr. Hutton's Course* (London, 1840); and, at pp. 273—4 of the work just cited will be found some remarks on the history of the problem.†

I am desirous of adding that I have pursued the subject of the New Algebra‡, in the *Philosophical Magazine* for December, 1848. I beg to refer the reader to my paper "On certain Functions resembling Quaternions, and on a new Imaginary in Algebra," at pp. 435—9 of vol. xxxiii. of the third series of that work, for further information on the subject. I take this opportunity of observing that, with respect to the geometrical interpretation of the new symbol, I have found reason to alter the opinion expressed at lines 12—14 of p. 366 of vol. xlix. of this Journal. An impossible space-entity may sometimes be interpreted so as to give an actual solution of a problem.

2, Church-yard Court, Temple, Dec. 29, 1848.

THE ELECTRIC TELEGRAPH.

On Wednesday the 3rd inst., a number of scientific gentlemen met at the new Railway Station, Hull, for the purpose of witnessing the testing of a subaqueous telegraph, which the Electric Telegraph Company have just laid down between the New Railway Station and the Company's Subscription-rooms in Bowl-alley-lane. It was a case of considerable interest to those connected in any way with submarine telegraphs, on account of the difficulty which presented itself in passing under the docks, where the depth of water varies from 18 to 24 feet; water, damp, and moisture being, as is well known, the most formidable enemies which the electric telegraph has to contend with—catching up as they do the electric current and dispersing it in all directions. The experiment was conducted by Mr. Reid, of London, one of the Company's engineers, and we are happy to say with perfect success. There were four copper wires insulated. Each wire was tested singly with a galvanic battery of 72 pairs of plates connected with a very delicate galvanometer; and the insulation between each wire, and also between the wires and the earth, was so perfect as not to produce the least perceptible oscillation in the magnetic needle of the instrument.

We hail this as a great step in electric telegraphy, and with the more pleasure, that there has been of late a sensible pause in its progress. We still entertain a strong hope that the day is not far distant when the metropolis will be telegraphically connected with all the principal cities and towns, not only of our own country, but of Europe—when every movement tending to the promotion of trade and commerce, or to the diffusion of peace and good will among mankind, will be simultaneously felt through the whole circle of European civilization.*

GREENWOOD'S RACK AND PINION SHUTTLE.

[Registered under the Act for the Protection of Articles of Utility. John Greenwood, jun., of Moldgreen, Dalton, near Huddersfield Wood, Turner and Shuttle Maker, Inventor and Proprietor.]

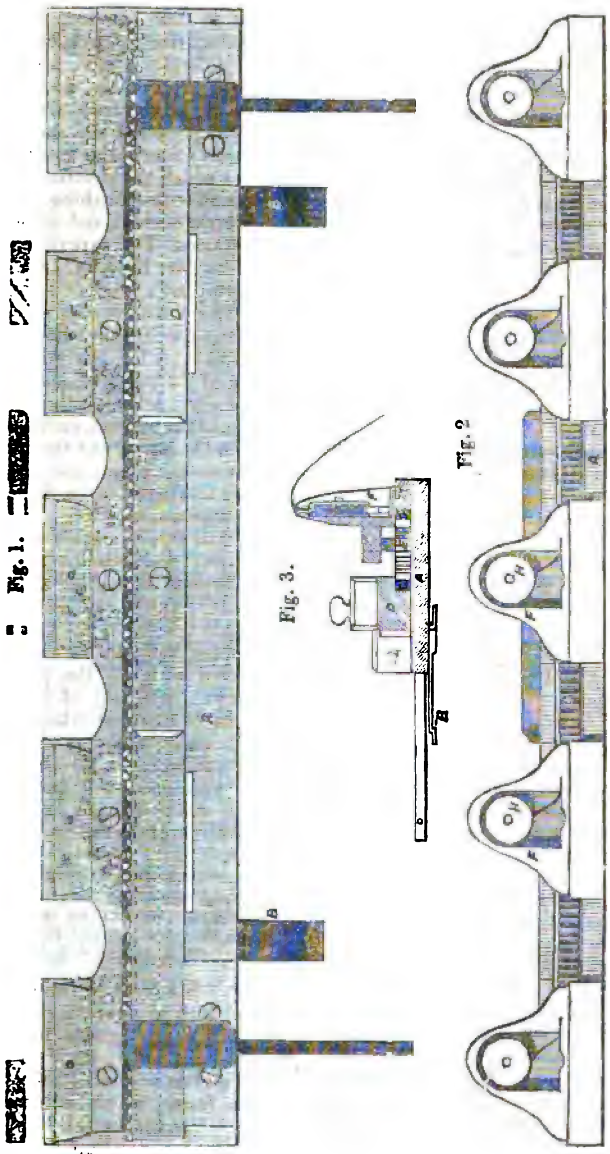
Fig. 1 is a front elevation of a shuttle frame, such as is ordinarily employed in weaving figured goods fitted with this improved shuttle; fig. 2 is a plan, and fig. 3 a cross section of the same. A A, is the frame, which is attached to the loom by iron brackets, B B; C is a toothed rack which is fixed upon the sliding-bar, D; the teeth of the rack gears into a series of pinions, E E E, of which there are two pinions for each of the shuttles, F F. The shuttles are each provided with a toothed rack, G, upon their

* See the *Liverpool Apollonius* (conducted by SWALE) No. II., p. 121.

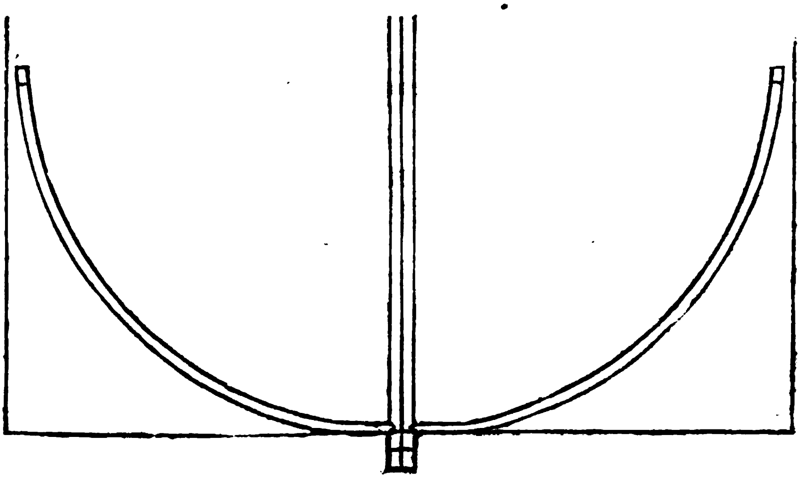
† And see YOUNG's (J. R.) *Math. Diss.* p. 159, and *Mech. Mag.* vol. xlix., p. 11.

‡ See *Mech. Mag.*, vol. xlix., pp. 364—7.

* For a description of Mr. Reid's excellent mode of insulation, see *Mech. Mag.*, vol. xlviii., p. 516.



lower side (at the back) which also gears into the pinions, E E E. When motion is communicated to the sliding-bar, D, by hand, or other power, the shuttles are, through the intervention of the racks, C and G, and the pinions, E E, made to traverse through a corresponding distance, but in the opposite direction to the slide bar. H H are the bobbins for containing the yarn in the shuttles.



Misrepresentations have too often the effect of turning attention from proposed ameliorations, but more especially so in regard to naval architecture; to this cause may in a great measure be attributed the tardy and partial adoption of several of the improvements which were exemplified in the war sloops, the *Arrow* and the *Dart*, and the war schooners, *Netley*, *Eling*, *Redbridge* and *Milbrook*, such as had bulkheads, water-tight compartments, diagonal braces, straight decks, &c., &c. From the very first construction of them, even in official reports of dock-yard officers, these vessels were stated to be unfit for his Majesty's service, but these and other false statements in respect to them, were at the time officially refuted. There remain, however, uncommented on, many particulars to their disparagement in Captain Brenton's "Naval History of Great Britain," and as that book is in the hands of many persons interested in naval affairs, both military and commercial, it seems useful to exhibit the groundlessness of Captain Brenton's statements, since many of the peculiarities of these vessels which seem worthy of imitation, remain still unadopted.

In volume the 2nd of "Brenton's Naval History," page 425, the *Dart* is described thus, "A curiously constructed sloop of war, after the plan of General Bentham, mounting 30 guns. Her bow and stern were of the same shape, and she could anchor by either end, though, it must be observed, very awkwardly, particularly in bad weather. She carried her water in wooden tanks, and was so sharp in her construction, that a transverse section taken in midships had nearly the form of a wedge. She had two topmasts on the same lower mast, parallel to each other, and her gangways were outside of the lower rigging; she had no stability in the water, and was found in blowing weather to be a very unsafe vessel. Captain Campbell made the only use of her for which she was calculated. He gallantly ran alongside the French frigate of 40 guns and 350 men as she lay at anchor, and carried her with great resistance."

The simplest mode of refuting this description, will be to take the several disparaging allegations successively one by one, as they occur in the above paragraph.

1st. "Her bow and stern were of the same shape."—Existing draughts of this vessel prove, on the contrary, that the bow and stern were of *different* shapes.* True, the ends of the vessel were alike,

* The shape of the experimental vessels, as described by Charnock, is very erroneous.

in so far as one improvement went, which tended materially to strength, namely, the mode in which the beams and the timbers were connected together, and also the increased thickness and disposition of the plank;* and she was of previously unexampled sharpness forward, with increased length in proportion to breadth—one of the peculiarities of these vessels which has been very generally and advantageously adopted.

2nd. "She could anchor by either end." This seems to have been admitted by Captain Brenton to be an advantage; but he qualifies his approbation of it by adding, "though it must be confessed, very awkwardly, particularly in bad weather." Amongst the numberless bad properties that were groundlessly attributed to the *Dart*, not a trace, excepting in Captain Brenton's work, of this alleged awkwardness has ever been adduced. The Captain seems to have forgotten this peculiarity of the *Dart*, when speaking in another part of his work of the battle of the Nile;† he there says, that Nelson, "for the *first* time recorded in the Naval History of Great Britain, proposed to anchor his ships by the stern; for this purpose his cables were passed out of the stern ports, carried along the side, and bent to the cables." This was two years after the *Dart*, and her sister ship, the *Arrow* had been constantly in commission. Had his Lordship's successful expedient for obtaining the advantage been spoken of as awkward, it could hardly have been disputed; whilst in the *Dart*, on the contrary, by means of the hause holes in the stern, anchoring was there effected as conveniently and perfectly as by the head.‡

3rd. "She carried her water in *wooden* tanks." These tanks were *metallic* tanks, first introduced in the *Dart* and the *Arrow*, with the double purpose of preserving water sweet at sea, and of enabling a ship to carry a much greater quantity than could be stowed in casks. These tanks were of tinned copper, but, for the sake of economy, too slight to stand without support; they were therefore strengthened by casings of wood, which were so formed and connected with the vessel, as to contribute to its strength. Water that had been kept upwards of three years in these tanks, obtained for Sir Samuel Bentham the gold medal of the Society of Arts; a premium which in this case may be considered as more than ordinarily honourable, since he was given to understand that it was the Admiralty itself which proposed the subject of preserving water sweet at sea, and that the funds for providing the medal were supplied from that quarter. Captain Brenton, however, in speaking of *iron* tanks,* gives *them* the credit of contributing to the comfort of the crew, and of enabling ships to keep longer at sea.†

4th. "Was so sharp in her construction, that a transverse section in midships had nearly the form of a *wedge*." So far was that section of the *Dart* from being of the form of a wedge, that a portion of a circle could hardly be said to represent it, since the lower part of it was nearly *flat*. An exact transverse section in midships of this vessel is given in the figure prefixed to this paper; which shows also the longitudinal bulkhead in which were sliding keel cases.

* *Mechanics' Magazine*, vol. xliii., p. 186, 189.

† It was before the battle of the Nile that the *Arrow* had an opportunity of exhibiting one of the advantages of these hause-holes. When the fleet under the command of Lord Bridport went down to St. Helens, the *Impetueux* (a ship of the line) got a ground on the spit, the *Arrow*, lying at anchor, immediately sent a hawser reeved through one of these stern hawser-holes, to be made fast to the ship aground, when by heaving at the windlass of the *Arrow*, the *Impetueux* was got off with great dispatch, and without injury.

‡ Brenton, vol. ii., page 306.

* Brenton, vol. iii. page 133.

† Brigadier General Bentham, in his evidence to the Committee on Finance, 5th April, 1798, mentioned, amongst other peculiarities of his vessels, which rendered them "more comfortable, and probably more healthy," the "goodness of the water," "preserved in tanks lined with tinned copper;" and that "others of the peculiarities exhibited on board of these vessels, took their rise from an idea which, if pursued with any degree of regularity to the extent of which it seems susceptible, will be seen to be productive of very great economy, at the same time that it would render naval armaments much more effective; this is, that of enabling ships to remain longer on their stations at sea, without intercourse with the land; and, more particularly, without the being frequently subject to those wants which require a naval establishment to supply." Amongst peculiarities with this view, he particularized, "the carrying in bulk, by means of the above-mentioned tanks, a greater quantity of water than can be stowed in casks." He also particularized a cooking apparatus, so arranged as that the fire for ordinary purposes could not be used "without its heat being applied to the distilling of fresh water from the salt." This apparatus was fixed on board the *Arrow*, but the sailors swore they would "dish it," and they did destroy it by boring holes in the steam chest. An apparatus, on the same principle, is just now under trial at sea, and which, as sailors are now more manageable, it is hoped will succeed.

5th. "She had two topmasts on the same lower mast, parallel to each other," With the trivial exception, that the *Dart's* masts were stepped on the platform instead of in the hold, there was no peculiarity whatever in the masts or rigging of this vessel. Her masts and geer were at her first outfit, precisely the same in form and magnitude as those of the *Cynthia*, but afterwards, in the beginning of the year 1800, and previously to her action in Dunkirk Roads, her masts and geer were changed for the established ones of a 20-gun frigate.

The *Dart's* sister vessel, the *Arrow*, had, indeed, two topmasts, but they were not *parallel* to each other; they were one *above* the other, as was stated to the Committee on Finance, 1798.

6th. "Her gangways were *outside* of the lower rigging." This could not have been, as when she was rigged as a 20-gun frigate, the order for so doing did not specify that any difference from the usual mode was to be observed; and none of the drawings of the *Dart* exhibit any such peculiarity. Her chain-plates "were extended as much outwards as in a vessel of the ordinary construction," although "they were fixed firmly to the post of the vessel best able to support them," "having been fixed through the thick strake along the range of the deck;" "they were thus less liable to injury than in the ordinary mode; and upon inquiry, it did not appear that any one chain-plate so fixed had ever been broken." But this mode of fixing them made no difference as to the gangways.

7th. "She had no stability in the water, and was found in blowing weather to be a very unsafe vessel." Captain Brenton does not adduce any particulars in evidence of the truth of this imputation, or mention any time at which the *Dart* was in danger: whilst on reference to the official reports respecting this sloop, and to letters from her several successive commanders, not a single instance has been found of her instability or of her unsafeness; whilst, on the contrary, many documents afford evidence in direct opposition to the Captain's disparaging assertion. Captain Campbell, for instance, in a letter dated 9th April, 1800, wrote—"On our passage to the Texel, with Admiral Mitchell and convoy, we were directed, with several others, to chase by signal; ours was the *last made*, it then blowing *excessively hard*, with a very heavy sea, so that we could only carry our courses and close-reefed topsails about two points from the wind. In a very short time we came up with and passed all those who had been sent on the same service, the ship making *excellent weather* of it, and *not straining in the least*. From what I could observe of the others, *they* seemed to be *much strained*, and gave up the chase shortly after we had passed them. This is only one of *many* instances in which I have seen her excel."

In his letter off Dunkirk, 27th May, he says, "She makes much better weather of it" than "any 28-gun frigate." "I assure you, on my word, we were as dry on our decks in the late gale, which was by no means a light one, as I ever saw a two decker in my life. In fact, we did not ship a spoonful of water, and the ship *perfectly easy*. I am informed by officers of ships in company, no part of them except their quarter-decks was dry." Captain Brownrigg, who succeeded Captain Campbell in the command of the *Dart*, wrote, 28th Dec., 1803—"I never saw a ship behave better in a sea than the *Dart*." "As a convincing proof of her being so very easy, we have not carried away a single rope of any description in all the bad weather that we have lately experienced." These, without farther quotations, seem sufficient to repel the groundless accusation that the *Dart* had no stability in the water, and was a very unsafe vessel; but it may be observed that General Bentham had no acquaintance with either of the Captains, Campbell or Brownrigg, previously to their appointment to the *Dart*; that their appointment was not owing to any recommendation of his; that they could not look forward to him for promotion; and that, therefore, their evidence could not have been influenced by any other motive than that of making a true statement of the qualities of the vessel they commanded.

8th. It is next stated, in depreciation of the *Dart*, that Captain Campbell made the only use of the *Dart* for which she was calculated. The whole statement by Captain Brenton relative to this exploit, besides bearing testimony of Captain Campbell's gallantry, carries conviction, the more it is examined into, of the many good properties of the *Dart*.

It appears that Captain Campbell was under the command of Captain Inman, of the *Andromeda*, a frigate of 32 guns, but which could *not* be brought to bear upon any one of the French frigates,—for there were *four* of them lying in Dunkirk Roads,—whilst Captain Campbell, in full confidence of the many good qualities of the *Dart*, did attempt, and did succeed in running alongside one of the four French frigates, the *Desirée*,—that he attacked her, carried her, in the presence and vicinity of the other three French frigates, and brought her safe into an English port, to be taken "a beautiful frigate into the English navy." The *Desirée* was of 1018 tons, the *Dart* of no more than 580; the *Desirée* carried really 40 guns and 350 men; the *Dart's* crew was but of 100 men—her armament of only 30 carronades; but they were, it is true, mounted *not* to recoil. No imputation has ever been thrown on Captain Inman's courage or his nautical skill; it is, therefore, but a fair and reasonable conclusion, that the *Dart*, though represented as so despicable, did, in fact, possess superior properties—such as gave her commander sufficient confidence in her to make an attack of which a frigate of the usual construction was not found capable, being incompetent to that good management of which the *Dart*, from her peculiarities, was susceptible. The Earl Vincent deemed this exploit in the *Dart* the most remarkable among the many glorious achievements of his time; and the gallant Captain Campbell was immediately promoted to post rank. The *Dart* continued to do good service, and was particularly noticed at the attack on Copenhagen, after which Lord Nelson affirmed, that she and her sister sloop, the *Arrow*, were each of them, in his lordship's estimation, equal in action to a ship of 90 guns.

MESSRS. CUNNINGHAM AND CARTER'S ATMOSPHERIC RAILWAY.

The disastrous fate of the Croydon and South Devon Atmospheric Railways, is a stubborn matter of fact, in the way of any one who would now advocate a further perseverance in the endeavour, to make the atmospheric principle available for locomotive purposes. Yet, why should the failure of one form of atmospheric railway—and that the only one which has been yet fairly tried—throw discredit on all other forms? It is only by successive stages that the existing railway system has arrived at its present state of excellence; for first there was the wooden tramway, next the iron tramway, then the edge rail, and, last of all, the question whether the engines should be stationary or locomotive; and why may it not be that the atmospheric system has but to go through a like series of stages to rival the other? The one atmospheric plan which has been tried in the case of the Croydon and South Devon lines, may have failed from causes from which others are wholly free; and if this can be clearly shown to be the case, the fact of its failure in these instances is one which ought to go for nothing—and certainly will not, in the mind of any person of ordinary candour and discrimination.

We have no intention of entering at present, into all the plans of atmospheric propulsion, which have at different periods been put forward as preferable to the abortive one of Messrs. Clegg and Samuda; we desire only to call attention to that which is now in the course of exhibition by Messrs. Cunningham and Carter, in the City-road,* and may be seen daily, in full operation, by any person desirous of having occular evidence of its merits.

We confine ourselves to this plan for two reasons; first, because this exhibition affords an immediate opportunity to all who may yet entertain a lingering hope of the success of the atmospheric system, of deciding for themselves, whether it is so very desperate an affair as the majority of the world (who judge by results only) at the present time imagine; and second, because the system of Messrs. Cunningham and Carter differs in all material respects more from that of Messrs. Clegg and Samuda than any other with which we are acquainted.

The railway exhibited is, to be sure, a model one only; but it is on a scale sufficiently large (one-eighth of the actual size) to leave no reason for supposing, that the results obtained by it, would differ materially from those, which might be expected to be realized in actual practice.

1. The longitudinal slit in the atmospheric main, and the extreme liability

* Messrs. Ingram and Sons' Factory.

to leakage (so to speak) consequent thereon, has been the grand source of failure in the case of Messrs. Clegg and Samuda's railway. In Messrs. Cunningham and Carter's there is no such slit—*no slit at all, in fact*—the tube being perfectly entire from the beginning to the end; and, consequently, there is no loss or waste of power from this cause.

2. The employment of a traction piston within the tube, which can travel no faster than the train itself, has formed another serious drawback to the utility of the plan of Messrs. Clegg and Samuda. Messrs. Cunningham and Carter *use no piston*, and are, therefore, subject to no such limitation.

3. The stationary steam engines employed to exhaust the main, cannot, according to Messrs. Clegg and Samuda's system, be more than about three miles apart, because of the rapid ratio in which the power of the piston decreases in proportion to the length of the exhausted tube, and because, also, the piston is moved by the atmospheric pressure behind it alone; but as Messrs. Cunningham and Carter use no piston, and are not dependent on the atmospheric pressure alone for their motive power, their system admits of the stationary engines being placed as far as ten or twelve miles apart; and hence a saving of at least two-thirds on the first cost of a line on their plan, and in the subsequent working expenses.

The mode in which Messrs. Cunningham and Carter have been enabled to surmount these three main causes of the failure of the Clegg and Samuda system, may be thus briefly described:—The vacuum (more or less) effected by the stationary pumping engines, is employed not to actuate a piston within the main, but to work, through the medium of a series of valves, small air engines placed at intervals outside of the main; each of these engines causes while in action a pair of horizontal wheels, one on each side of the rails, to revolve in the direction of the transit; the peripheries of these wheels catch against bars attached to the sides of the carriages, and, by the friction between them, give a forward impulse to the carriages (proportionate to the diameter of the wheels and the length of the side bars); the moment the carriages have acquired that impulse, and passed through between the horizontal wheels, they touch in passing certain tappets, which arrest the action of the air engines (which, if they worked longer, would work to no purpose;) and the distances between these engines are so adjusted that the carriages may derive not only all the benefit of the impulse so imparted to them, but all the benefit of the momentum due to the force with which they are impelled. For full explanatory details of this system, we beg to refer to the patentee's specification of it, given in a former number of this Journal (vol. xlvi., p. 411.) And here it is due to them to remark, that there is an exactness of conformity between their specification and the model now exhibited, such as is but rarely witnessed in the case of patented inventions—affording unmistakeable evidence, of the system having been thoroughly matured in the minds of the inventors, before they submitted it to public scrutiny.

The reader will see, at once, that no inference can fairly be drawn, from the failure of the Clegg and Samuda system, to the prejudice of one so free from its chief defects, and so decidedly different from it altogether, as this. The saving to be achieved by its adoption may not be so great as the patentees themselves calculate—(see *Mechanics' Magazine*, vol. xlvii, page 285), but we cannot bring ourselves to believe that any possible corrections to which the calculated saving may be subject, can reduce it so low as to make it inexpedient to give the system an ample trial on an actual working scale. Even supposing it were to turn out, that such a high degree of speed as is called for by the present travelling wants of the public, could be obtained by shortening the intervals between the air engines or enlarging the diameters of the impelling friction wheels, it might nevertheless be established by such a trial, that for lesser speeds on bye lines of small traffic, it would be the most economical system that could be adopted (a conclusion to which we ourselves much incline).

Among the minor advantages insisted on (but with commendable deference) by Messrs. Cunningham and Carter, the following are worth citing: One main tube suffices for a double line The main tube is placed under ground, and thus offers no obstruction to the trains crossing and

backing on the line, and to other vehicles passing over the line at level crossings—the train can be stopped in an instant, either by the conductor or by any authorized persons stationed by the side of the railway—A single line (such as the South Devon) may be made to suffice for an increasing traffic by merely doubling the line at certain stations, to allow the trains to pass each other. And, lastly, branch lines may be added to the main trunk, without any additional stationary power.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JAN. 13.

JOSEPH CLINTON ROBERTSON, of 166, Fleet-street, London, civil engineer. *For improvements in the manufacture of gas for illumination, and of the residual products into articles of commerce.* Patent dated July 6, 1848. (Communicated from abroad.)

Firstly. The gas for illumination is manufactured in manner following from rosin, in conjunction or combination with potash and lime, or soda and lime, or potash, lime, and soda, or any one or two of the said substances, in combination with any other alkaline substances, one, two, or more, and in conjunction also with sawdust or any other fibrous vegetable matter, in a finely comminuted state. These crude materials are mixed together (in proportions for which no specific rules are given, as almost any combination of them is productive of a beneficial result), and placed in moveable cast-iron cases, of a cylindrical or any other form adapted to the shape of the retort in which their distillation is to be afterwards effected, which cases are permanently closed at one end, and have at the other end caps, covers, or plugs, which are fitted to them loosely so as to be easily driven off by a little external pressure. These cases are placed in a retort precisely similar to an ordinary gas retort, and set like it in brickwork; and they are so arranged as to leave room for the escape of the caps, covers, or plugs when driven off, as aforesaid. This retort being heated in the usual way, the resulting volatile or gaseous products are conveyed by a tube into a second retort of the same description as the first, filled, or nearly so, with lumps of coke or lime, or broken brick, or other like materials in a fragmental state, in order that they may present a large decomposing surface, and heated to a cherry redness previously to the introduction of the gaseous products. If only a very pure gas, for purposes of illumination, is desired to be obtained, the gas which escapes from the second retort is made to travel through a third or fourth retort, filled with materials of the same description, and in the same incandescent state as those used in the second. But.

Secondly. When it is desired to separate and collect the oil or oleaginous matters held in suspension by the gaseous products resulting from the distillation in the first retort, these gaseous products are passed through a close tank nearly filled with water, and fitted with an ascension pipe that leads to a hydraulic main, such as is in ordinary use in gas manufactories. The water retains the oil or oleaginous matters, or at least the larger portion thereof, while the gas which passes off to the hydraulic main is conveyed thence to a water washer, passed next through a dry lime or milk of lime chamber, and finally transferred to a gasholder.

Thirdly. From the oil obtained in manner aforesaid, an artificial grease of a superior quality is made, by mixing it with milk of lime or dry lime, and adding a quantity of zinc, or some one or other of the alloys of zinc, reduced to a granulated state, in the proportion of about five parts of zinc, or alloy of zinc, to each hundred parts (by weight) of the oil.

Fourthly. From the same oil there is obtained a spirit, which may be used both for illumination and as a varnish or vehicle for colours, by distillation and rectification. In first distilling the oil, care is taken not to raise the temperature higher than is just sufficient to give the oil, which is originally of a yellowish colour, a brownish or tawny appearance. The spirit which comes over from this first distillation is afterwards rectified by re-distilling it once, twice, or oftener in combination with a small quantity of lime, in each instance, until it attains any required degree of whiteness. The proportion of lime to spirit which is found to answer best in practice, is about three-quarters of an ounce of the former to each pound weight of the latter.

Claims.—1. The manufacture of gas for illumination from rosin, by mixing it with alkaline and vegetable fibrous substances, and exposing these crude materials to the action of heat in cases placed in retorts, and passing the resulting volatile or gaseous products through retorts, one, two, or more, filled with lumps of coke or lime, or broken brick, or other like materials in a fragmental and incandescent state, as before described.

2. The separation and collection of the oil or oleaginous matters contained in the volatile or gaseous products resulting from the first distillation of the said crude materials, by passing the same through water, as before described.

3. The manufacture from the said oil of an artificial grease, by the admixture of lime and zinc, or some alloy of zinc, as before described.

4. The manufacture from the said oil of a spirit, by the process and the means before described.

WALTER ORBELL PALMER, Southacre, Swaffham, Norfolk, farmer. *For improvements in machinery for threshing and dressing corn.* Patent dated July 10, 1848.

The machinery for threshing and dressing the corn are both contained in a quadrangular case mounted upon wheels, in which also is placed a seat for the workman to sit in and feed the straw. In front of the seat is fixed a longitudinal portion of a cylinder, which is made open to allow the grain to pass through with its concave circumference, towards the seat, and between them, the beater is suspended on an axis. Beneath, is another portion of a cylinder, joined end to end with the first, in which a small straw-striker revolves. A third portion of a cylinder is joined end to end with the second, and nearly in the same horizontal right line, in which the large straw-striker revolves. Underneath all these is an endless band, made to move towards the head of the machine, upon which the corn and small straw are received as they fall through, and by which they are carried into a trough. The threshed straw is delivered by the large straw-striker out at the back of the machine. The corn and small straw is then lifted by means of a chain of endless buckets out of the trough, and emptied into a shoot, which conducts them into a riddle. The riddle rests at one end on springs, and at the other upon a connecting rod attached to a crank shaft, whereby a rapid up-and-down motion is communicated to it, so that the small straw is delivered out, while the corn falls through into an ordinary dressing machine. The different parts of the threshing and dressing machines are driven by a steam engine or other prime mover through the intervention of endless bands.

Claims.—So combining the threshing and dressing machine, that the corn, as it is threshed out, shall be carried to the dressing machine; and the employment of the riddle to separate the small straw from the corn, preparatory to its passing into the dressing machine.

GEORGE BEATTIE, Edinburgh, builder. *For an improved air spring and atmospheric resisting power.* Patent dated July 6, 1848.

The "improved air spring" is adapted to doors or gates opening both ways, and consists of a box let into the floor, which contains a vertical axle or shaft, supported at bottom in a hollow cup, and furnished at the top end, which projects above the floor, with a shoulder for carrying the door. On this shaft, and within the box, is fastened a horizontal wheel which is toothed upon a portion of its circumference, and separated from the other portion of the box by horizontal partitions, above and below it. On either side of this wheel is a rack, attached to corresponding pistons, which are made to fit tightly into cylinders by cap leathers. In the bottom of each cylinder is a pipe communicating with a valve-box, which is furnished at the opposite end with another pipe. The teeth of the wheel are made to take into either of the toothed racks, accordingly as the gate or door is opened one way or the other, so that the piston of the rack in gear with the wheel will be drawn along its cylinder, leaving a vacuum behind, at an uniform and regular degree of resistance until the door is released, when the unbalanced pressure of air upon the other face of the piston will cause the door to resume its original position. The valve apparatus is so constructed and arranged, that in case of a leakage, that is of air getting behind the piston, it shall be driven by the return of the piston, through the valve out of the opposite pipe. The entry of air or dirt into the cylinders is prevented by the valves; and the whole of the apparatus is kept well lubricated.

When the door or gate is intended to open one way, one cylinder with its apparatus is used only, and a toothed segment of a circle is substituted for the partially toothed wheel, with such other slight modifications as convenience may suggest.

The atmospheric resisting power (buffing apparatus, we presume) consists of a cylinder containing two cylinders arranged concentrically and on the same right line. Each of these cylinders is furnished with a piston, made to fit tightly by cap leathers, and attached to the same piston-rod which carries the buffer head. The end cylinder is furnished with a valved pipe passing through the outer cylinder, which establishes a communication with the atmosphere, while the other, that is the one nearest to the buffer head, is kept sealed from all communication with the external air, and the outer cylinder filled with oil to keep the whole of the parts lubricated. The effect of this arrangement will be that, when the buffers are brought into action, a resistance will be offered to the further passage of the piston-rod within the cylinders, composed of the vacuum created before the piston of the first cylinder, and of the air compressed behind the piston of the second cylinder, during which operation the valve will of course be closed.

Another buffing apparatus consists of a series of cylinders arranged end to end within an outer cylinder, and furnished with pistons and piston-rods, which are made to slide one within the other, so that each piston may be brought into action successively. The resistance in this apparatus results from the vacuum created before, and air compressed behind each piston.

Claims.—The manufacture of springs for doors or gates, in which the elastic power of air is made to act towards a vacuum.

The means of combining buffing apparatus with the joint action of a vacuum and compression of air. Also, the employment of successive chambers to produce vacuum, and of the reaction of the air.

William Edward Newton, Chancery-lane. *For improvements in the construction of stoves, grates, furnaces, or fire-places for various useful purposes.* (Being a communication from abroad.) Patent dated July 6, 1848.

The patentee describes a peculiar construction of close stove, which consists in placing within a radiating chamber a vertical fire-pot composed of metal, or of refractory earthenware, and partially surrounded by a sheet of metal, which is cylindrical at the back of the fire-pot and tangential to the sides. The ends of this sheet of iron are made fast to the front of the radiating chamber, and are turned over at top, so as to form a hot-air chamber all round the fire-pot, with the exception of a small annular space round the top of the fire-pot. Air is admitted into this chamber through holes perforated in the front of the radiating chamber, and regulated by a suitable apparatus. Fuel is conveyed into the fire-pot through a tube, fitted with a door, in the radiating chamber, as usual. On the top of the radiating chamber is a horizontal plate, in which is suspended a throat* or funnel-shaped tube, the top aperture of which is smaller than the bottom and the mouth of the fire-pot, which is smaller than the bottom aperture of the throat. A drum, into which the top aperture of the throat opens, is superimposed on the top plate of the radiating chamber. A tube descends from the drum into the radiating chamber, which is furnished with a pipe opening into the chimney.

On fire being kindled in the fire-pot, the products of combustion will ascend till they are on the point of passing into the throat, when they will meet and commingle with the heated air which escapes from the hot-air chamber through the annular space round the fire-pot into the throat, and thence pass in an inflamed and inflaming state into the drum, throwing out heat on all sides. The products of this second combustion pass down the tube into the radiating chamber, whence they escape through the pipe into the chimney. In some cases, the hot air may be introduced into the midst of the products evolved from the combustion of the fuel, by an arrangement of apparatus similar to that of the argand burner. This construction of stove may, it is stated, be modified to suit the purpose to which it is to be applied, and adapted to open and cooking stoves, to puddling furnaces, dyers' kettles, evaporating pans, &c.

Claims.—The combination of the chamber of combustion, in which any kind of fuel is burned, with a drum or chamber of combustion, in which the products evolved from the combustion of the fuel are rendered inflamed and inflaming by means of a "throat."

The making the top aperture of the throat smaller than the bottom one, and than the opening of the fire-pot, in order that the products evolved may commingle with the air before they pass into the drum.

The making a portion of the throat of larger diameter than either the top or bottom aperture where the air is introduced into or among the products of combustion.

Introducing jets of air, among the products of combustion, whereby they are rendered inflamed and inflaming.

John Martin, Killyleagh Mills, County Down, manufacturer. *For improvements in preparing and dressing flax, tow, and other fibrous substances; and doubling, drawing, and twisting flax, tow, and other fibrous substances to be used for such purposes.* Patent dated July 6, 1848.

These improvements refer (1) to an apparatus for sharpening the teeth of cards employed in preparing fibrous materials, and removing the dirt from between, (2) To a peculiar construction of heckling machines; (3) To the application of steam to fibrous materials; and (4) To an apparatus for varying the drag upon the bobbins.

1. The sharpening apparatus consists of a shaft, supported in suitable bearings, in a slanting direction across the face of the main cylinder, which carries the carding teeth, arranged spirally, on its periphery, in fillets. The shaft is made with a longitudinal groove, and fitted with toothed gearing and adjusting screws, whereby it may be made to revolve, and to approach or recede from the cylinder, as required. A collar, furnished with a feather upon the inside, which takes into the longitudinal groove, and carrying a number of circular cutters, is slid upon the shaft. These cutters are bevelled off at the edges, to allow the

* The patentee appears to regard the throat as composed of the funnel-shaped tube and of a slight portion of the top of the fire-pot.

teeth to take in easily between them, and also between the angular portions, which are cut like a small file. The number of cutters upon the collar is one more than that of the rows of teeth in each fillet, in order that each row of teeth may pass between one pair of collars. Above the cutters are suspended a corresponding number of circular plates, which, preceding the cutters, take between the rows of teeth, remove whatever dirt may be adhering them, guide the points between, and keep them in close contact with the file-cut portions of the cutters. When this apparatus is to be brought into action, the collar, with its fittings, is placed upon the highest end of the shaft, and its feather in the longitudinal groove, so that, on rotary motion being communicated to the shaft, the collar and cutters will also partake of it, and descend gradually to the bottom of the shaft, after passing successively between each row of teeth in the fillets.

2. The patentee specifies two kinds of heckling machines, the descriptions of which extend over four skins of parchment, illustrated by ten sheets of drawings, and cannot, therefore, be made intelligible by any mere abstract.

3. The mode of applying steam in the preparation of fibrous materials, consists in causing it to issue from a perforated pipe into and among the flax, tow, or other fibrous materials, as it is drawn by the drawing rollers from the retaining rollers.

4. The mode of varying the drag of the cords upon the bobbins, consists in making the notched bar moveable, and causing it to slide endways, with the cords in the notches, so as to increase the drag as the bobbins are filled.

Claims.—The arrangement of apparatus for sharpening the teeth of cards in carding engines, and for removing the dirt from between them—The arrangement of heckle stacks in cocks moved outwards by strikers. —The combination of receivers for causing the traversing to be made correctly—The arrangement of an apparatus for governing the descent of the flax, whereby the holders may be caused to move at a different speed, and the speed of each holder varied—The application of steam in the preparation of fibrous materials. And the arrangement of apparatus for varying the drag upon the bobbins.

Enoch Steel and William Britter, Lambeth, Surrey, manufacturers. *For improvements in the manufacture of tobacco-pipes.* Patent dated July 6, 1848.

The clay, after being reduced to the proper plastic state by any suitable means, is forced through the perforated bottom of a cylinder; or projected through perforations in a vertical plate, in the form of rolls of the requisite diameter. The rolls are afterwards cut into lengths containing sufficient clay or other material to form the bowl and stem of the pipe. The clay is then placed in a mould, the top portion of which is cylindrical inside, while the lower part is so shaped as to give the exterior form to the bowl. The mould is in two pieces with an indentation in the bottom to form the spur, and an opening through which the clay is expelled to form the stem. A pin made fast in the back of the mould is kept in the centre of this opening to form the hollow in the stem. A number of these moulds, filled with clay, are fixed securely in a chase, whereby they are brought successively beneath a plunger worked by a hand lever, and submitted to its action. The lower part of the plunger is turned so as to give the desired form to the interior of the bowl, and it has a small point projecting from the bottom, which enters into a hole in the pin, and thus establishes a communication between the bowl and the stem. The upper part of the plunger is furnished with a collar flanged at top, which fits accurately into the cylindrical part of the mould above the bowl portion. When the plunger is forced down by the hand lever, the clayis driven entirely out of the cylindrical part of the mould into the bowl-shaped part, where a portion is left sufficient to fill the space between the plunger and the sides of the mould to form the bowl, and the rest is expelled round the pin through the opening to form the hollow stem. To prevent the bowl being lifted up by the raising of the plunger, and to facilitate its withdrawal, the flanges of the collar are caught by springs, when the plunger is forced down, which springs are sufficiently strong to keep the collar in its place. A small button is fixed in that part of the plunger which is underneath the collar, and takes into a longitudinal slot in the latter. The plunger is constructed with a central air tube communicating with the external atmosphere, and closed at bottom by a valve opening outwards. The effect of these arrangements is that when the plunger is to be withdrawn, the lower edges of the collar press against the top edges of the bowl, and remains in close contact with them (thereby preventing the bowl from being displaced) until the end of the slot catches against the button, and overcomes the resistance of the springs to the free ascent of the plunger and collar. During this time the valve will open sufficiently to admit air beneath the plunger, and thereby prevent any sucking. The hole formed in the back of the bowl by the pin may be closed by pinching or otherwise, and the stems curved, after

which they are ready for firing. Or the pin, for forming the hollow in the stem and the spur, may be dispensed with, and a hole in the bottom of the mould, through which the stem is expelled, be substituted for the side opening, while the bottom of the plunger is fitted with a point projecting sufficiently far downwards to enter the bottom opening before the clay is expelled, so as to serve instead of the pin, and form the hollow in the tube.

Claims.—The apparatus constituted by the arrangement and combination of mechanical parts described, in reference to the manufacture of tobacco pipes, and to the compressing of the clay or other material in a mould or moulds to form the bowls, and expelling the surplus through an opening to form the stem, whereby the bowl and stem are made at the same time.

ANTHONY LORIMER, Bell's-buildings, Salisbury-square, bookbinder. *For improvements in combining gutta percha and caoutchouc with other materials.* Patent dated July 10, 1848. (Gutta Percha Patents, No. XIV.*)

1. *Improved mode of cleansing* gutta percha. The blocks are cut into thin shavings, which are afterwards dried, and teased or bent in all directions, whereby the foreign matters are separated. The shavings are cut by thin sharpened strips of steel, which are arranged spirally upon two discs, to give a dragging cut, fixed on a common axis. The block of gutta percha is supported in claws upon a screw, whereby it is kept up to the cutters. When the block is nearly shaved down, it is removed, and cemented upon the top of another block, and the operation repeated. Or, the blocks are cut by short cutters, arranged spirally upon the periphery of a drum, or radially upon the surface of a disc; or, by a peculiarly shaped cutter, the outline of which resembles that of a longitudinal section of the nautilus shell. The shavings of the gutta percha are then dried, and next placed in a hopper, the aperture of which is adjustible to regulate their fall into a cylinder which contains a second cylinder. The inside circumference of the outer cylinder is fitted with four double rows of spikes, at equal distances from each other, and projecting inwards; and the inside cylinder is fitted with the same number, projecting outwards, and so arranged that the spikes of the one cylinder shall pass between those of the other without touching. A portion of the bottom of the outer cylinder is composed of wire gauze, and made to open. On rotary motion being communicated to the axis of the inner cylinder, the shavings of gutta percha will be so teased and bent in all directions, that the foreign matters will be separated from them, and fall through the wire gauze. When the shavings are sufficiently cleansed, they are removed to what the patentee terms a welding apparatus, which consists of a cylinder encased in a steam jacket, and fitted on the inside with three rows of bars or spikes, projecting inwards. In the centre of this cylinder is an axis, carrying four rows of bars or spikes, projecting outwards, which take between those of the cylinder, whereby, on the axis being made to revolve, the gutta percha will be drawn into strings, and in this state the other matters hereafter mentioned may be added. And lastly, the gutta percha is made to pass between a pair of rollers, indented on their peripheries, and arranged so that the knobs of the one shall take into the indentations of the other, whereby it is kneaded into a homogeneous mass.

2. A *new compound of gutta percha* is formed by mixing with it burnt clay, burnt flint, porcelain, China, earthenware, Portland, Cornish, or other stones, ground to a fine powder; oxide of copper or of zinc, hydrate of lime or oxalite of lime, or lime slaked with water acidulated with oxalic acid. This mixture may be added, it is stated, to the gutta percha in the "welding machine." Or, the gutta percha may be rolled out thin upon a metal plate heated by steam or hot water, and dusted over with the compound. The sheet is then folded, dusted, and rolled out, refolded, redusted, rerolled, and so on, until a sufficient quantity of the compound is incorporated with the gutta percha.

3. A *new compound of caoutchouc* is formed by combining it with oxide of copper and lime slaked with water, acidulated by oxalic acid, and may be applied to the waterproofing of fabrics.

Claim.—The means of cleansing gutta percha preparatory to its being compounded with other materials. The compound of gutta percha. The compound of caoutchouc.

LEON CASTELAIN, Poulton-square, Middlesex, chemist. *For improvements in the manufacture of soap.* Patent dated July 11, 1848.

This improvement consist in mixing gum carragan, or Irish moss, or any other moss of like character, with soap. 112 parts of gum carragan or moss are dissolved in 472 gallons of hot water, and mixed with salt in the proportion of four ounces to one gallon of the solution. The soap is run into "frames," and intimately blended with the mixture in the proportion of five to one.

Claim.—The employment of gum carragan or Irish moss, or other moss of like nature, in the manufacture of soap.

* For preceding Gutta Percha Patents, see *Mech. Mag.*, Nos. 1180, 1181, 1182, 1183, 1185, 1200, 1232, 1233, 1283, 1286, 1291, 1300, 1319.

WEEKLY LIST OF NEW ENGLISH PATENTS.

John Coope Haddan, of 29, Bloomsbury-square, civil engineer, for an improvement or improvements in railway wheels. January 5; six months.

Francis Hobler, of Bucklersbury, London, gentleman, for improvements in the construction of the cylinders or barrels of capstans and windlasses. January 11; six months.

Michael Loam of Treskerley, Cornwall, engineer, for improvements in the manufacture of fuzees. January 11; six months.

Christopher Nickels, of the Albany-road, Surrey, gentleman, for improvements in preparing and manufacturing India-rubber (caoutchouc.) January 11; six months.

William Rowe, of New Wharf, Whitefriars, London, carpenter and joiner, for certain improvements in the mode of uniting or combining pipes or lengths of pipes, tubes, or channels formed of glass, earthenware, or other similar material. January 11: six months.

William Walker, of Manchester, agent, for certain improvements in machinery or apparatus for cleaning roads or ways, which improvements are also applicable to other similar purposes. January 11; six months.

Miles Wrigley, of Ashton-under-Lyne, architect, for certain improvements in the manufacture of yeast or barm. January 11; six months.

William Edward Newton, of Chancery-lane, civil engineer, for a certain improvement or improvements in the construction of wheels. (Being a communication.) January 11; six months.

James Castley, of Harpenden, Hertford, manufacturing chemist, for improvements in the manufacture of varnishes from resinous substances. January 11; six months.

Robert Urwin, of Ashford, Kent, engineer, for certain improvements in steam engines, which may, in whole, or in part, be applicable to pumps and other machines not worked by steam power. January 11; six months.

Obed Blake, of the Thames Plate Glass Company, residing at 13, Southampton-street, Strand, gentleman, for certain improvements in ventilating or ventilators for or in ships, vehicles, houses, or other buildings. January 11; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Jan. 5	1721	Stock and Son	Birmingham	Economic water closet.
6	1722	Dixon, Sons, & Tooke	Hatton Garden	Safety clasp.
,,	1723	Stock and Son	Birmingham	Economic self-acting water closet.
8	1724	Joseph Human	Ely	Rain protector.
9	1725	Buller and Co.	Walsall	Bit for horses.
10	1726	Geo. Henry Baskcomb	Chiselhurst, Kent	Triune dog-cart.
,,	1727	Thomas Cartwright	Birmingham	Ladies' improver, or bustle.
11	1728	Simcox, Pemberton, & Sons	Birmingham	Blind furniture.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co. Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

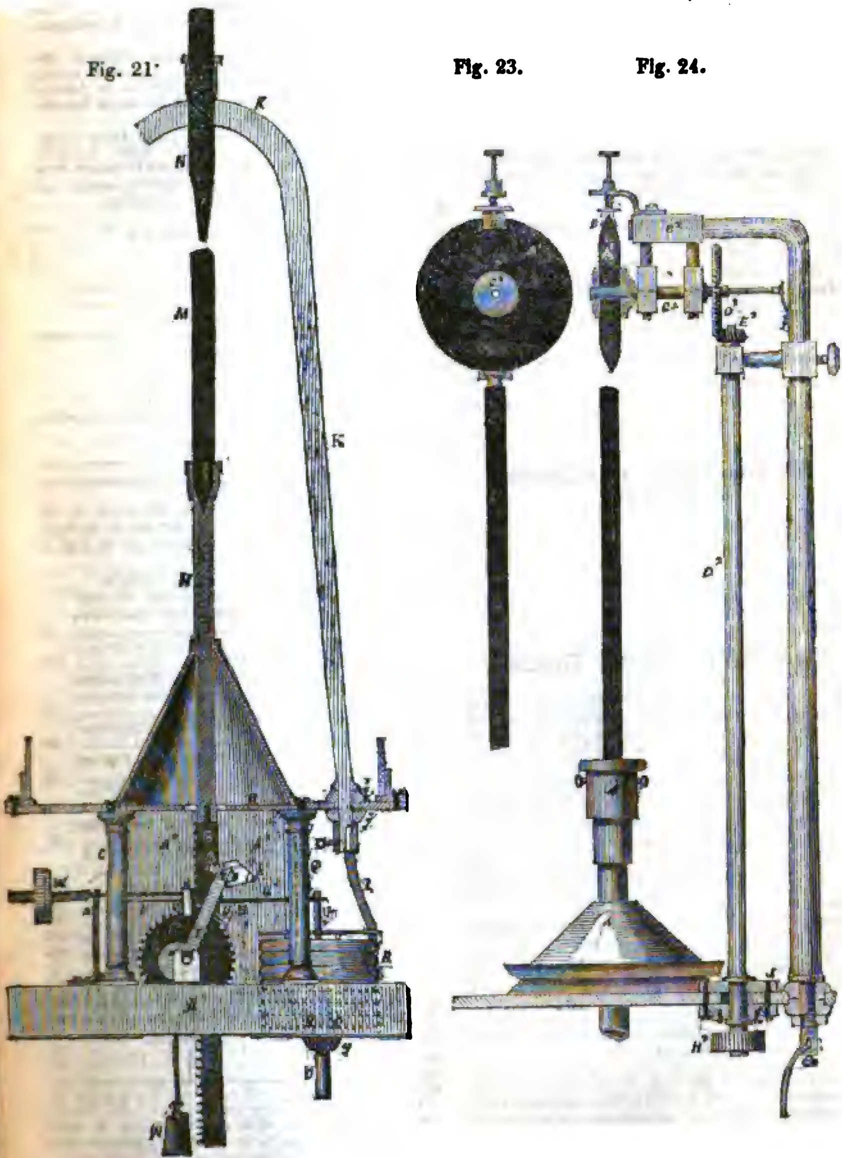
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1328.] SATURDAY, JANUARY 20, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

STAITE'S PATENT ELECTRIC LIGHT.

Fig. 21. Fig. 23. Fig. 24.



STAITE'S PATENT ELECTRIC LIGHT.

[Patent dated July 13, 1847; specification enrolled July 13, 1848.]

We have now the pleasure of being the first to lay before the public an authentic statement, in the words of Mr. Staite's own specification of his last patent (enrolled a few days ago) of his successful mode of applying electricity to lighting purposes, in its latest and most approved form; and also of several important inventions and improvements made by him having relation, more or less, to the same singularly interesting branch of applicate science. Mr. Staite's long and arduous endeavours to subdue the lightning of the heavens—hitherto so fearful in its manifestations—to the dominion of man, for his delectation and comfort, are universally known, and we believe we may add, highly esteemed by all who are qualified to appreciate them. One of the most striking pieces of information supplied by his present specification is the fact, that the chemical products of the batteries he employs are of greater value as articles of commerce than the exerting elements employed, and that consequently the light developed *costs literally nothing*.

Firstly. My improvements in the construction of galvanic batteries, consist in making them on what I call the "perfluent" system of supply and discharge, to contradistinguish it from the "percolating" system, which has recently come into extensive use. According to the percolating system, the liquid employed (usually sulphuric acid) is supplied to and discharged from each of the cells of the battery, in separate and distinct streams or series of drops; the liquid, as it becomes exhausted, though not entirely so, dropping out through an orifice in the bottom of the cell, and being then allowed to run to waste, and the place of the discharged liquid being supplied by fresh drops descending from above into each cell. But, according to the new system, to which I have given the name of "perfluent," the liquid is supplied in one stream only, which passes continuously through the entire series of cells, entering by the first cell of the series, and passing off through the last. The great loss attending the imperfect exhaustion of the portions of liquid discharged from each cell, is thus avoided; for the liquid, flowing in one stream through the whole of the cells, one after the other, becomes completely exhausted, or as nearly so as may be, before its final discharge from the last of the cells. In ordinary galvanic batteries, when a perforation is made in the partition between any two of the cells, so that they may communicate transversely with one another, a considerable diminution of electric intensity is known to be the result; but no such diminution is observed to take place in the perfluent battery, from bringing the cells into communication with one another, owing to the circuitous course which the fluid is made to take between cell and cell. In proportion, of course, as the duration of the transit through each cell is shortened, the chance must be proportionally lessened of each portion of the liquid coming into contact with the acting metal or element in that cell; yet, as no drop of the fresh liquid supplied to the battery can make its way to the final discharge outlet without going through the whole of the cells, what it misses in the first cell, it is sure to encounter in one or other of the remaining cells. The cells last in order of a perfluent battery necessarily act less powerfully than the earlier cells of the series; as, for example, the last six cells of a series as compared with the first six. The diminution of power, that is to say, the quantity of electricity which the cells are capable of circulating, does not appear, however, to follow exactly in the ratio of the strength of the exciting liquids; for the difference in power between the middle and initial cells of a series is proportionally not so great as the difference between the middle and the terminal cells. When it is desirable to obtain intensity in the electric current rather than great quantity, the terminal cells should be made about equal to the quantitative power of the others, by uniting the similar conducting wires of several cells together, and using them as if proceeding from one cell. Thus, as it would be technically expressed, the last three cells in a fifteen cell battery (say the 15th, 14th, and 13th), might be connected for quantity, and the two next preceding pairs (say the 12th and 11th and 10th and 9th) be connected also for quantity, and the first eight cells might be worked singly, in the usual manner of a series. But, however great may be the differences in power between the initial, middle, and terminal cells of a series, I find that in each cell, regarded by itself apart from the others, the degree of exhaustion, and consequently of electric action, is always very nearly uniform throughout every part of the cell. In consequence, moreover, of the liquid being in a state of continuous flow, and never acting on any one part of the cells more than another, the zinc or other metal employed wears much

Fig. 19.

Fig. 18.

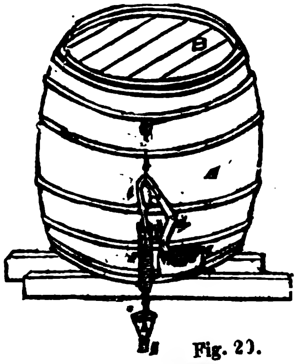


Fig. 5.

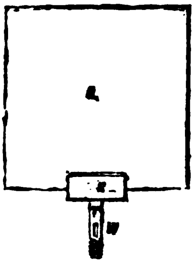


Fig. 6.

Fig. 7.

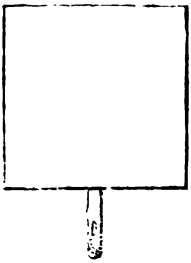


Fig. 8.

Fig. 9.

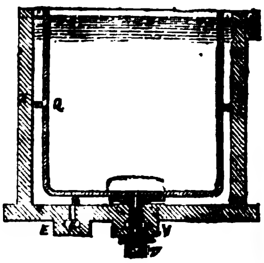


Fig. 20.

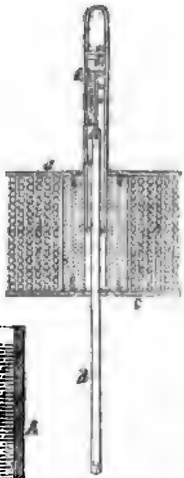


Fig. 11.

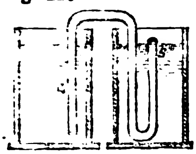


Fig. 4.

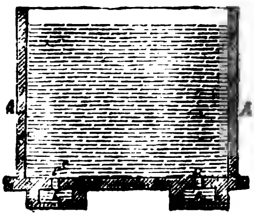


Fig. 22.

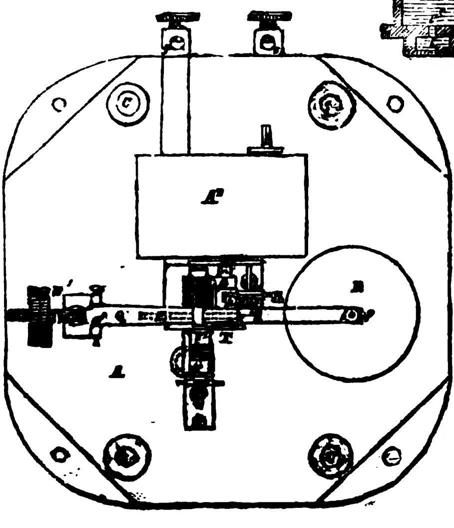
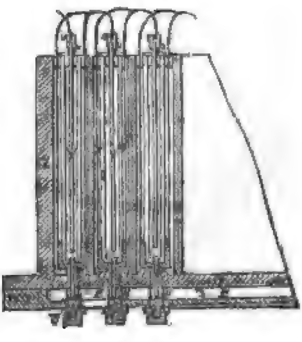


Fig. 10.



more evenly than in the percolating battery, or any other with which I am acquainted.

The details of a battery constructed on this perfluent principle are represented in figs. 1, 2, 3, and 4 of the drawings annexed. Fig. 1 is a view of the battery, as seen from above; fig. 2 is a vertical longitudinal section; fig. 3 is a view of the trough from beneath; and fig. 4 is a vertical cross section. A is a wooden trough, the parts of which are firmly bolted together; *aa* are slate partitions, the edges of which fit closely into the sides and bottom of the trough, and are about two and a half inches apart; *bb* are thicker partitions of wood, which are inserted at short intervals, say every six cells, and made fast to the sides by screws and nuts. *c c*¹ are two parallel rows of holes made in the bottoms of the cells, two in each; *d d*¹ are two corresponding rows of wooden covers, which are made fast by marine glue and screws to the bottom of the trough (see fig. 3), one underneath each adjoining pair of holes, as *cc* or *c*¹ *c*¹, with the exception of the two end ones, which cover one cell only; *e* is a groove cut out in the upper surface of each cover, and made just of width enough to embrace two of the cell holes, as *cc* or *c*¹ *c*¹, and so establish a channel of communication between them; *f* is an aperture made in the bottom of the end cover of the series of holes; *d* and *f*¹, similar apertures in the bottom of the opposite end of the same series of holes, into each of which apertures there is inserted a piece of copper tubing, to which there is attached one end of a flexible hose, *g* or *g*¹ (made of vulcanized caoutchouc, gutta percha, or any other suitable substance or combination of substances), which terminates at the other end in a funnel, *h* or *h*¹; and *i i*¹ are eye-bolts affixed to the ends of the trough on the outside, which respectively sustain in an upright position the funnels, *h* and *h*¹, there being a slit or opening in the eye of such bolt, to admit the neck of the funnel. The whole of the inside of the trough is well coated with marine glue.

The mode of operation with this apparatus is as follows:—The liquid is poured in at the funnel, *h*, and passes into the first cell through the hole, *o*, of that cell; from the first cell it goes out through the hole, *e*, into the first of the grooved covers of the series, *d*, whence it flows into the second cell through the hole, *c*′, of that cell; from the second cell it next passes through the hole, *c*, of that cell into the second of the grooved covers of the series, *d*; and so on to the end of the series (as indicated by the arrows in fig. 1) when it discharges itself through the flexible hose, *g*′, and *h*′, into a receiving vessel, K.

The arrangement just described is, however, chiefly suitable for those batteries which use but one sort of exciting liquid but in batteries where two fluids are used, as those of Daniel, Groves, and Callan, it may be expedient to adopt the modification of the perfluent system represented in figs. 5, 6, 7, 8, 9, and 10. The internal cells in this case are supposed to be made of earthenware or some other porous material. Fig. 5, is a side view of one of these cells, and fig. 6 a vertical section across the middle. A hole, Q, is made in the bottom of this cell and into this hole a varnished copper tube, *r*, with a collar and washer of vulcanised caoutchouc at top is dropped. The tube is pulled tightly down upon the washer in order to prevent any of the liquid escaping between the washer and the bottom of the cell. Or, instead of this arrangement, one of the description represented in figs. 7 and 8 may be substituted.—S, is a cradle which is cemented on to the under end of the cell by marine glue, and encloses it completely. The tube, *r*, is screwed on to the bottom of this cradle, and through it up to the hole in the cell. In both cases the tube has an oval aperture, *w*, cut transversely through it, and terminates at its under end in a solid screw point. The trough for the reception of porous cells of this description is made in the manner represented in figs. 9 and 10; the former being a transverse vertical section of the trough through the centre of one of the cells, and the latter a longitudinal vertical section. (In these figures, the cradle on the plan, figs. 7 and 8, is supposed to be adopted.) Q is the internal porous cell, and Y the zinc plate suspended therein. XX, are the plates of negative surface, say copper, placed outside of the porous cell. ZZZ, are the sides and bottom of the trough, the spaces, *m m*, between which and the porous cell form the external cell, which contains the second fluid (say sulphate of copper). A[a] is an open channel for the discharge of the second fluid, which runs along the outside of one wall of the trough, near to the top, and communicates by lateral apertures, *p p*, in the wall, with the spaces inside, *m m*, appropriated to that fluid. V is a grooved or channelled under-cover, similar to those employed in the apparatus first before described, which extends along the bottom of the trough from end to end, and comes immediately under the line of holes in the porous cells, Q. The lower end of the tube, *r*, which is attached as aforesaid to the bottom of each porous cell, and inclosed by the cradle, is passed downwards through an orifice in the bottom of the trough, and also through another orifice

in the bottom of the under-cover, V, till the oval aperture, *w*, in the tube, coincides with the groove, *t*, in the bottom of V, so that when the whole of the cells are fixed in their places, the channel, *t*, forms through the medium of the apertures, *w w*, a common channel of communication between all the cells. U, is a nut which takes on to the end of the solid screw point of the tube, *r*, and by turning which the parts S, *r*, V, and Z, are all screwed tightly together. For the sake of greater security

Fig. 2.

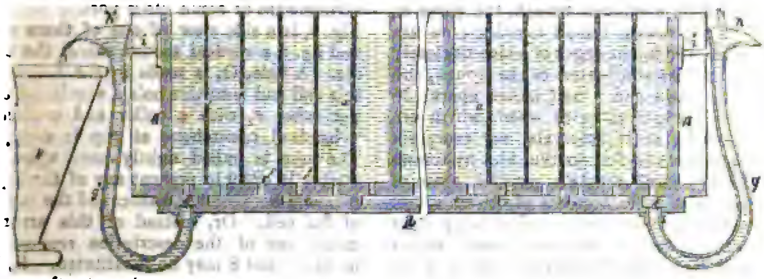


Fig. 1.

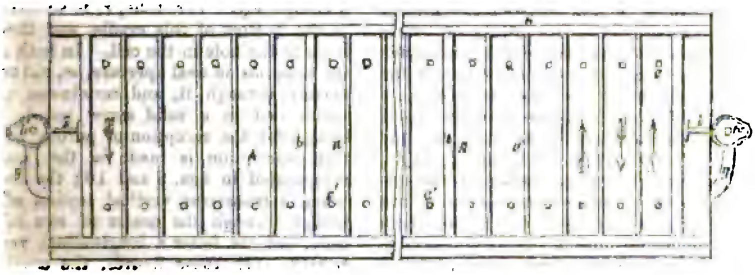
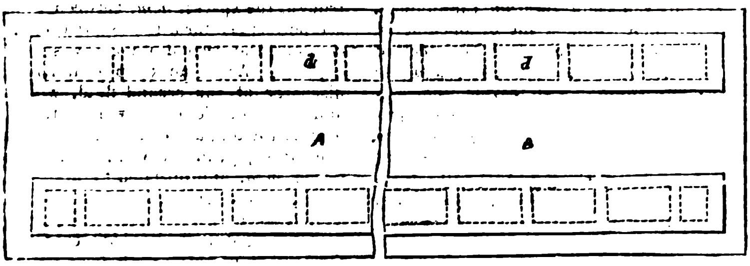


Fig. 3.



against leakage, and against the intermixture of one of the fluids with the other washers of vulcanized caoutchouc, are inserted between the cradle, S, and the bottom of the trough, and between the bottom of the grooved channel, V, and the shoulder of the nut, U. E, is a second under cover which runs parallel to V (on one or either side of it), the groove, *e*, in which second cover, communicates by a series of holes,

n n, with the external cells above, containing the second fluid, and thus serves as a common channel through which these cells may be supplied from a flexible hose, similar to that before described. The second fluid is, after passing through the external cells, discharged from the end of the channel, A[e].

The perfluent system may be also carried into effect by employing syphons instead of the grooved under covers, *d*, *d'*, V and E, before described, to transmit the liquid from cell to cell successively, as shown in fig. 11, which represents two adjacent cells of a battery. The long end, A, of the syphon descends to near the bottom of one cell, in order that it may carry over the densest portion of the liquid therein, and deliver it through the short end, B, into the next cell. Or, if the liquid employed is of such a nature that it becomes lighter as it becomes exhausted (sulphate of copper for instance), then the legs of the syphon are reversed, the liquid entering it by the short end, and being carried over by the long end. By adopting this syphon plan, the breakage or upsetting of one cell of a series will not cause any loss of liquid from the rest, although the liquid will continue at the same time perfluent; nor will the syphons empty themselves until the last portion of the liquid is removed from the cells, which need not be done during the replenishing or changing of the liquids.

The syphon plan just described may be applied with special advantage to a form of battery which has been for some time in use (with some appendages, however, which do not belong to this apparatus as originally constructed and hitherto known), inasmuch as that application would convert it at once into a perfluent battery, nearly equal to that first hereinbefore described. In its general construction, this battery resembles that first described, with the exception that, though all the cells communicate at bottom with one common discharge channel, the liquid does not flow continuously from one cell to another through the whole series; but, supposing all the holes in the bottoms of the cells were stopped up, and syphons applied to each pair of cells, as has been just described, then there would be a continuous flow of the liquid throughout the entire series, from the last of which it might be discharged, in an exhausted state, by a flexible hose similar to that represented in fig. 2.

Secondly. My invention consists of certain improved modes of regulating the supply and discharge of the liquids employed in galvanic batteries.

The first mode which I shall describe will be found particularly applicable to a battery such as that referred to at the close of the preceding head of this specification, and consists in using it with certain new appendages to it in manner following:—

Into the wooden partition at one end of the trough is imbedded a syphon, one leg of which opens into a channel, and the other leg passes through the bottom of the trough. The short end of the syphon is made to be on a level with the intended height of the liquid in the trough; and there is a small aperture in the highest part of the bend, which communicates with a hole cut in the wood, which has a seat around it, half way up, on which lies a washer of vulcanized caoutchouc. The broad end of a screw screws down on to this seat, presses on the washer, and closes the hole air tight. When the cells are filled up, the syphon discharges all the liquid out of every cell in the trough; and when the screw is turned loose, the bent tube no longer acts as a syphon, but simply discharges liquid, as its level may rise beyond the level of the bend. The fresh liquid is introduced in any convenient manner at the top of each of the cells. When it is desired merely to replenish the exhausted liquid, or when it is required to fill up all the cells with fresh liquid after they have been partially emptied, the whole quantity of liquid necessary is poured into one of the cells, and spreads in equal quantities to every cell. My improvement in this arrangement consists in substituting a flexible hose and funnel, and their respective appendages, for the discharge syphon before described, and in working these in the following manner:—The flexible hose is lowered at regular intervals of, say 15, 20, or 30 minutes (according to the quantity of liquid contained in the cells, and the rate of action of the electricity, and the degree of steadiness required in the current), and at each time a portion of the partially used liquid is allowed to run out, after which the hose is raised again, and the funnel replaced in its original vertical position, when a quantity of fresh liquid, equal to that which has been just discharged, is poured into the funnel, and is conveyed thence into the cells through the common channel. When this battery is so worked, the liquid will be always kept about three-fourths exhausted, or nearly so, in which condition the battery may, in some cases, be worked up to about two-thirds of its power. There will always, however, be a slight waste, as the liquid must, of necessity, be always discharged with about one-fourth of its power unused.

A second mode of supplying the cells has relation to the case in which the liquids become specifically heavier by working the battery (as, for example, dilute sulphuric

acid). I cause a constant influx into each cell by means of a pipe or trough extending along the top of the battery, having a small orifice over each cell, so that the liquid with which the pipe is charged, shall drop gradually into each cell, and the liquid is drawn off from all the cells simultaneously by means of a common under channel. The funnel, or other vessel of supply, is fixed in an upright position, just about the level at which it is intended to keep the liquid inside the cells. By this arrangement all the cells are kept practically at the same level, and no separate attention to each cell is requisite.

A third mode of carrying this branch of my invention into effect has relation to liquids which become specifically lighter by the working of the battery (as, for instance, sulphate of copper). The cells are replenished by a continual outflow from a supply vessel fixed at a higher level than the liquid in the cells (similar to A^a in fig. 9), through holes or spouts placed at the required level in the side of each cell. This in practice ensures an equal feed for every cell while the battery is working, because, if any cell were worse supplied than the rest, with fresh liquid from the bottom, it would in a short time become more exhausted than the rest, and consequently specifically lighter, which would make it attain a higher hydrostatic level and overflow more abundantly than the others.

A fourth mode has reference to porous cell batteries, and is based on the supposition that the batteries are regularly supplied with liquid. The object in this case is so to proportion the supply to the amount of current produced, that any given portion of the liquid (say sulphate of copper solution) supplied to the lower part of one division of each cell, shall become exhausted by the time it has worked its way to the surface, when, supposing the solution to have been sulphate of copper, it will have become transformed into a clear solution of dilute sulphuric acid. I allow the exhausted solution to flow over the upper edge of the porous cell into the zinc compartment (instead of drawing it away and supplying the acid to the zinc from another cistern), when this solution becomes gradually charged with zinc and is finally drawn off, and exhausted a second time, from the bottom of the zinc cells by suitable arrangements.

Thirdly. My invention consists in attaching to all galvanic batteries in which a gradual change of liquid is required, an equilibrated hydraulic cistern and graduated meter, such as represented in figs. 18 and 19. A is a cask, closed at top, so as to prevent the action of the atmospheric pressure on the surface of the liquid contained in it; and *b* is an orifice near to the bottom, which opens into a small outer cistern, *c*. This arrangement ensures that the liquid flowing through any channel from the little cistern, *c*, will always flow at the same rate, whether the cistern be full or nearly empty. From this little cistern a loose piece of vulcanized caoutchouc tubing, *d*, proceeds, and is connected with the glass tube, *e*, from which is suspended the meter, *f*, having a small hole at the bottom, so that the rate of flow out of this hole is indicated by the height at which the surface of the liquid stands. The metre is graduated to units, which show the amount of flow requisite to supply the chemical action which is going on in the battery when the electric current is circulating at a rate indicated by corresponding units on the galvanometer described in fig. 20, which is included in the circuit. The meter with its tube, *d*, is suspended, so as to enable the rate of flow to be adjusted by hanging it at an altered level in relation to the cistern, according as the galvanometer may indicate to be necessary. The parts, *d e*, form in fact a syphon, which only requires to be filled with liquid when the apparatus is first set in action, after the cistern is charged. The liquid issuing from the meter is received by a funnel, *h*, or otherwise led to the battery.

Fourthly. My invention consists in the employment in galvanic batteries, having copper or mercury for the negative element, of a liquid amalgam of zinc, and mercury enclosed in a bag or case, of lawn or horse-hair cloth, or any other finely reticulated fabric, but not made of metal, which allows of the acid passing freely through its meshes to act on the bottom and sides of the zinc amalgam, while the bag, or case, retains the amalgam itself. I am aware that a liquid amalgam of zinc and mercury has been before used in place of an amalgamated surface of solid zinc, but to the best of my knowledge, never in the way now proposed.

Fifthly. My invention consists, in the substitution in galvanic batteries, of solid plates made of an amalgam of zinc and mercury in the proportion of five parts of the former, to one part of the latter, for the zinc plates ordinarily employed.

Sixthly. My invention consists in the employment of lead as the positive element in galvanic batteries (instead of the zinc which is now commonly used), combined with a solution of nitric acid or of acetic acid, in some one or other of the forms best calculated to act on the lead. The best negative element in this case would be a surface of platinum, but most of the other negative elements which have been hitherto used may be also employed with the lead.

Seventhly. My invention consists of an improved galvanometer, which is to be attached to the battery, in order to indicate to the eye the exact amount of galvanic electricity which is being circulated at any particular moment. The galvanometers usually employed for measuring the quantity of an electric current, are incapable of being used while the battery is applied to perform its work, nor can they indicate the amount of action or electricity circulating while such work is being performed, and these, with several other defects—such as their indications or degrees varying in a different ratio to that of the quantity of electricity passing—cause such galvanometers to be useless for most practical purposes. My new galvanometer is such that it can be made a permanent adjunct to, or part of the battery, so as to be always indicating what amount of electricity is circulating, when any sort of duty is being performed by it, and the weights of materials combining or used per minute at any particular time. The importance of these improvements may be measured by this consideration, that the cost of working a battery depends but little on the size of its elements, and varies precisely according to the rate at which its electricity is used by any particular work which it is set to perform. This improved galvanometer consists of a thick piece of insulated copper wire, A, wound round a wooden or brass cylindrical centre, fitted with ends, CC. One end of this coil is in metallic connection with the positive or negative pole of the battery, and the other extremity is placed in connection with the part of the lamp (or other piece of mechanism for actuating which the battery is used), which would receive the conductor from the said pole of the battery. In fact, this galvanometer forms part of one of the conductors of the battery, which conveys its electricity to perform its assigned work. In the hollow cylindrical centre of the coil there is placed a rod of soft iron, *d*, as shown in the figure, which moves loosely up and down in it, and is prolonged by a short brass stem or index, *e*. A graduated scale, *f*, is fixed to, and rises from, the upper end of the coil, so as to show the height at which the electric influence causes the index to stand. The graduations are represented in the figure as marked on a glass tube, within which the index and rod, *d*, slide. These graduations are so made as to indicate the number of grains of pure zinc, consumed per minute, in each cell of the galvanic series, the current produced by which causes the index to stand at each such division of the scale. Any galvanometer of this kind can be graduated from a standard one, by connecting both in the same circuit, and by working a Wheatstone's rheostat, also included in the circuit, until the standard galvanometer indicates the particular units or degrees, when a similar mark should be made at the point to which the index is directed on the scale of the other galvanometer. The standard can be graduated by ascertaining experimentally the weight of zinc consumed per minute; but a less tedious process is to graduate it from a *Petrie's Galvanometer*, which indicates all the required units of electricity and their fractions, by means of weights; the accuracy of that instrument being first tested by one such direct experiment on the zinc consumed. My improved galvanometer may be made of a shorter and thicker wire, making fewer coils, if the iron rod is partially counterpoised by a spring or weights, or hydrostatically with mercury.

Eighthly. My invention consists in the formation of magnets in manner following: The best Swedish charcoal iron is to be "converted" not in the ordinary manner, but only by a slight carbonization, or what is technically termed carbonizing it "just steel through." The blistered product is then melted and cast, and the ingot resulting from the process is rolled out into thick sheet metal.

Ninthly. My invention consists in the following improved mode of hardening magnets previous to magnetizing them. Instead of heating them as usual in an ordinary furnace, or sand bath, I heat them in a bath of melted metal raised to a red heat (using by preference lead); first polishing the magnets in order to prevent the lead or its oxide from adhering to their surfaces—the heat of the lead being only just sufficient to harden the magnets. On taking them out of the bath, I afterwards plunge them into water.

Tenthly. My invention has relation to the mode of obtaining light by electricity, for which I obtained former letters patent for England and the Colonies on the 3rd day of July, 1847; and consists, first of all, in an improved mode of giving motion to the lower electrode. Figs. 21 and 22 are representations of a lamp embodying this improvement. The skeleton of this lamp is similar in all respects to that of the lamp represented in the specification of my last patent. That is to say, there is as before a foundation plate of wood, A, a sole-plate, B, of brass, firmly connected by pillars, C, and a three-legged stand, K, rising vertically from the sole plate, B, the feet of which are fastened to B by nuts beneath, but insulated by circular washers of dry hard wood (of the form shown in sec-

tion *i, j*). A hole is bored vertically down through the centre of the top of the stand, K, into which hole the upper electrode, N, is fixed by three metal wedges jambed into key ways or channels, sloping upwards and outwards, so as to keep the inner faces of the wedges parallel to the central axis. A glass shade is fixed to the sole plate, B, so as to cover K. The new parts are as follows: HG is a shaft which slides vertically into the central axis of the lamp, through holes in A and B, and has a socket at top which carries the lower electrode, M. The lower part, G, is cut with teeth which work into a pinion, F, which turns on a spindle in fixed supports. A barrel, F′, is attached to the pinion, F, and a weight, W, is suspended by a string which passes round, F′, and is fixed to it, so as to counterpoise the weight of HG. On the spindle of the pinion, F, is fixed a wheel, E, having square teeth. A lever, T, turns loosely on the same spindle as a fulcrum, and carries a double paul, UV, which turns on a pin which projects from the side of T, so that this paul, UV, can lock into the teeth of the wheel, E, in either direction. A long horizontal lever, Q, passes over this paul from a joint or fulcrum, *a*, and this lever carries a light spring, or tongue, *l*, close beneath it, the end of which is kept from springing away from the lever, by resting in a step in a little stirrup or fork, *d*, which is attached to the lever, Q, and embraces the wheel, E, and the end V of the paul. The paul and its lever, T, are kept in a state of slow vibration from side to side by means of a crank, S, which works in a fork at the end of T, the crank S being made to revolve by an ordinary train of wheel work, furnished with an escapement or fly-wheel, A², and driven by spring power or weights. When the lever Q is turned a little downwards, its tongue, *l*, presses V into the teeth of the wheel, E, and the vibratory motion of T causes V to drive the wheel round, notch by notch. The wheel does not follow the paul in its back motion at every stroke, for this is better ensured, by having a spring, *n*, (fig. 22) fixed to A, and pressing against the side of G. This motion of the wheel causes the pinion to elevate the rack G, slowly, so as to raise its electrode, M, towards N. But when the lever, Q, is raised or turned upwards, the notch in the stirrup lifts the tongue, *l*, off V, and allows U, the heaviest end of the paul, to drop into the teeth of the wheel, E. This drives it round in a contrary direction, so as to lower the rack, G, and draw its electrode M, further from N. Whenever the lever Q is raised, the lower step in the stirrup, *d*, catches the sides of V, and draws it (V) up out of the teeth of the wheel, in case V should have become jambed, or hitched, in the teeth, so that the counter weight of U might be unable to release it. The means by which the end of the lever, Q, is raised or lowered, are these: R is a regulator coil, such as is described in the specification of my last patent, one end of its wire is connected with the binding-screw, *e*, and the other end, L, is brought up and fixed in contact with K. An iron-rod, O, moves freely up and down in the central hole of the coil, and is prolonged upwards by a stem of wood, *p*, by which it hangs to the end of the lever, Q, in the manner shown in figs. 21 and 22. The rod, O, passes through a hole in the centre of a cup, *y*, which screws into the bottom of the coil case. Around O there is a circular weight, X, called an equilibrium weight, which rests on a small step in O, when O is raised. When O sinks below its medium position it is left behind, resting on the edge, or rim of *y*. The object of this arrangement is, that when O is actuated by a force equal to its own weight, added to half the weight of X, then it will have a tendency to return to its medium position, with a force of half the weight of X, whether it be raised higher, or sunk lower than that position. The mode of action is as follows: the end of the negative wire from the battery is set in the binding-screw, *f*, and is conducted thence by a metal connection, to the supports of the spindle of the pinion, and to the spring, *n*. The current passes through these into the rack; thence to the lower electrode, M, from which it passes to the upper one, N, producing the light between them. From N it proceeds through the stand, K, to the wire, L, of the regulator; thence to the clamp, *e*, which is in connection with the other end of the regulator wire, and into which the positive wire from the battery is clamped to complete the electric circuit. The current, in passing through the regulator, tends to raise the iron centre, O, which, being connected to the lever, Q, is counterpoised by the weight, W¹, which screws along an extension of the lever beyond the fulcrum, *a*. To put the lamp into adjustment, the driving gear being wound up, and the battery being in a state of activity fit for the permanent action intended to produce the light, and its wires connected with *e* and *f*, as described, the lever Q, is raised by hand until the electrodes have separated to the greatest extent compatible with obtaining a permanent light from them. The screwed weight, W¹, is turned backwards or forwards until it keeps O balanced, just so as not to sink below its medium position, when the electrodes are separated as aforesaid. When in this position the shoulder

of O touches the weight, X, which is resting on the rim of *y*. The lever, Q, carries a little projecting piece or catch, *g*, which meets the bent arms attached to the crank-spindle, S, and thus arrests the motion of the crank, when the lever lies so that O is in its medium position; but whenever it rises above or sinks below that point, the catch, *g*, allows *hh* to pass beneath or over it accordingly, so that the crank can revolve freely and work the ratchet, UV.

Another improvement in the lamp consists in substituting for the upper electrode, previously employed, a disc or circular electrode fixed on an axis, which disc has a slow motion imparted to it, in any given direction, by the moving power employed in the lamp. Impinging on the periphery of this disc, there is a metal scraper, which keeps the edge of the disc clean, and free from the particles of carbon which are projected upon it by the other electrode, and which ordinarily collects in the shape of a button on the point of the electrode. A front view of a lamp on this plan is given in fig. 23, and a side or edge view in fig. 24. A^1 is the disc, which, as shown in section, fig. 24, resembles in its form two cones, placed base to base, so that there is always one sharp or feather edge in sight (so to speak) of the negative electrode, which is of the ordinary single-cone form. B^1 is the scraper; B^2 is a frame, which carries the shaft, C^2, to which the disc electrode, A^1, is attached. D^2 and E^2 are a bevelled wheel and pinion, which gear into one another, the latter being fixed to the shaft, G^2. At the bottom of this shaft there is another wheel, H^2, to which the clock-work or other apparatus for giving motion is attached. The shaft, G^2, may be insulated in various ways, either by the interposition of plates of ivory or wood, J K, screwed together, or by gutta percha or India-rubber rings. Instead of the shaft, G^2, and the wheel and pinion, D^2 and E^2, a metallic chain may be used, working over a pulley or pulleys, the object being to give a slow motion only (say one revolution an hour) to the circular disc of carbon, and for the purpose solely of keeping the edge of the disc sharp and free from the projected particles, as described.

(*To be continued in our next.*)

IMPACT—ITS RELATION TO STATICAL PRESSURE.

Sir,—It must be sufficiently apparent from the pages of the *Mech. Mag.*, that even amongst professional engineers of high standing, and more than ordinary scientific attainments, a decided variance of opinion exists in respect to the relation which obtains between a force of impact and the statical pressure of a quiescent body. Mr. Stevenson, in his paper upon the Marine Dynamometer (vol. xlviii., p. 437), admits that an objection may fairly be taken to representing a force of impact by another force composed of continuous pressure. Mr. Dredge is decidedly of opinion (vol. xlix., p. 486) that a force of impact cannot be represented by a statical pressure —while a "Steam-ship and water-wheel Engineer" (vol. xlix., p. 587) is as decidedly opposed to that opinion, and asserts that a dead weight pressure is the only standard which science is able to furnish for the measure of an impulsive force.

This diversity of opinion upon a most important point in applied mechanics, and among men, too, in whom we might have least expected it, must necessarily be more or less annoying to practical persons of less scientific research, but who, nevertheless, feel the necessity of founding their estimation of such effects upon unchanging rules deduced from the fixed principles of science; while it shows, moreover, that our ordinary occupations in life, furnish instances of force, upon the cirumstances of which, even the refinements of physical analysis have not yet been able to pronounce a conclusive fiat.

The case of driving a pile into the earth by the impact of a metal ram falling freely by the force of gravity, and striking the pile head, is one familiar to the mind of every practical engineer; but how, otherwise, is the amount of force expended in driving the pile to be estimated, if not by reference to the ordinary standard of weight? If, by a single impact, the pile is driven through a given space, and that we estimate the quantity of work done in producing that effect, it would appear that our doing so is a direct reference to the standard of statical pressure, inasmuch as the amount of work thus assigned is barely an expression for the number of pounds of dead weight which would produce the same effect.

If W = the weight of the ram, v its velocity at the instant it strikes the pile head, and $g = 32\frac{1}{6}$ feet, then is

$$U = \tfrac{1}{2}\frac{W}{g}v^2, = W \times \left(\tfrac{1}{2}\frac{v^2}{g}\right),$$

the amount of work accumulated in the

ram at the instant of impact, and reproduced in driving the pile. Now, if U have a given definite value when $W v^2 =$ the constant C, the value of U will not be affected by varying indefinitely the *separate* values of W and v, so long as the product $W v^2 = C$. It follows, therefore, that as the equation of work obtains, whatever may be the value of v, subject to the imposed condition that $W v^2 = C$, it is true when v is indefinitely small, or when the factor

$$\left(\tfrac{1}{2}\frac{v^2}{g}\right)$$

in that equation, diminishes without limit; and when it becomes evanescent $U = W$: that is, the quantity of work due to the whole impact is represented by a statical pressure W, which would produce the same effect in an exceedingly small period of time.

I have stated above that the amount of work accumulated in the ram during its fall is reproduced in driving the pile; it is not, however, to be inferred that the whole of that amount is *effective* in overcoming the resistances opposed by the soil to the progress of the pile. Retaining the previous notation, and putting w for the weight of the pile, then it may be easily shown that the amount of work expended during the impact upon the compression of the impinging surfaces, is

$$\frac{W.\,w.\,v^2}{W+w} \times \frac{1}{2g},$$

which in nowise contributes to the driving of the pile. This amount, then, is a clear drawback upon the work accumulated in the ram, and the difference only is effective in giving motion to the pile.

$$\therefore\ W. \left(\frac{v}{2g}\right) - \frac{W.\,w.\,v^2}{2g(W+w)}$$

is the effective work upon the resistances offered by the soil through an unit of space, which by reduction becomes

$$R = \frac{W^2\,v^2}{2g\,(W+w)}. -$$

Let us now endeavour to apply these formula to a practical case, in which the weight of the ram = 1120 lbs., the height of fall 16 feet, and the weight of the pile with shoe and cap = 900 lbs. The work accumulated in the ram before impact

$$= \tfrac{1}{2}\,\frac{W}{g}\,v^2 = 1120 \times 16 = 17920 \text{ lbs.}$$

The work expended upon the compression of impinging surfaces

$$= \frac{W.\,w.\,v^2}{2g\,(W+w)} = \frac{1120 \times 900 \times 16}{2020} = 7984 \text{ lbs.} :- \therefore\ 17920 \text{ lbs.} - 7984 \text{ lbs.} = 9936 \text{ lbs.},$$

the effective work done upon the resistances opposed to the motion of the pile.

Permit me now to observe that the foregoing remarks are in no respect intended as a reply to any objections which may have been urged against representing a force of impact by the pressure of a quiescent body. My observations merely go to show the views I hold myself upon this subject, and which I have hitherto believed to be fair deductions from the theory, however the results might be found modified in practice. It may have been observed that I have omitted in my investigation several elements which would, no doubt, more or less influence the results; I have considered the impinging surfaces inelastic—I have neglected any resistance which might be opposed to the free fall of the ram, and other elements of less moment, which, while they would render the formulæ more intricate, would not, perhaps, alter materially the gross results. Feeling most anxious to learn the views of some of your able contributors upon this highly useful subject, I confess that at present I see no possible means of estimating the amount of a force of impact, except by reference to a statical pressure.

I am, Sir, yours, &c.,
T. Smith.

Bridgetown, Wexford, Jan. 11, 1849.

THE "SARAH SANDS" AND THE AUXILIARY STEAM AND SCREW SYSTEM.

[We quote the following "results of two years' performance" of the *Sarah Sands* screw steamer from a circular issued by Mr. Grantham, C.E., of Liverpool, by whom she was designed and fitted with her machinery. The evidence which this document affords of the advantage of the auxiliary steam and screw system is most conclusive

and satisfactory, and reflects great credit both on the planner and owners of the vessel.—Ed. M. M.]

First year ending December, 1847.

Now that this fine ship has completed four voyages to New York, and is laid up for a short overhaul, previous to her next voyage, it may be interesting to view the results of her performance. She was built with a view to test the practicability of carrying on the general trade between this country and America by means of auxiliary steam power; and judging by the results, the experiment seems to have been entirely successful.

In first attempts of this kind, allowance must always be made for difficulties in the machinery, arising from the novelty of the various parts, and such difficulties, though not of a serious nature, have been experienced in this case. No drawback has, however, appeared in the general principle.

It is well known that the New York packets are amongst the finest trading vessels in the world, and a comparison with some of the best of these on the outward voyage, where the greatest difficulties are encountered, will give a good idea of the performance of the *Sarah Sands*:—

SARAH SANDS.	SAILED.	TIME.	PACKETS PASSED.	AVERAGE TIME.
1st Voyage ...	January 20, 1847....	20½ days ..	.... 6	48 days.
2nd Voyage...	April 6th, ,, ...	23 days ..	.... 6	36½ ,,
3rd Voyage..	June 15th, ,, ...	*34 days ..	.... 6	47 ,,
4th Voyage...	Sept. 3rd, ,, ...	20 days ..	.... 4	32 ,,

A fact connected with the last voyage is interesting. She took out a valuable though light cargo—a large number of passengers, and coals sufficient to work her out and home, with eighty tons to spare, steaming the entire distance—a performance, we believe, wholly without precedent in the annals of steaming.

The *Sarah Sands* is an iron ship of 1,000 tons, builders' measurement, and 1,300, new measurement; engines 180 horses power, coupled direct to the screw. She has extensive accommodation for first, second, and third-class passengers, and can stow about 900 tons of goods, besides coals for the voyage.

Year ending December, 1848.

The *Sarah Sands* has just completed her second year, having performed five voyages between the 22nd of January and the 4th of December.

During the present year she has continued to run with great regularity and success. The average time outward has been 18¼ days, and homeward 16½ days—always deeply laden. Her shortest voyage outwards was 16 days, and homeward 13½ days. She has carried during the present year the large number of 1,800 passengers across the Atlantic without the slightest accident, and has delivered her cargoes in excellent order.

These facts are not only interesting to those engaged in the New York trade, but are of great importance to the shipping interests of this country.

She will sail again on the 20th of January, and the owners have made some slight improvements in the machinery and accommodations which will tend to make her performance still more successful.

FENN'S REGISTERED DOUBLE-HEADED CYLINDER WRENCH.

[Registered under the Act for the Protection of Articles of Utility. Proprietor, Joseph Fenn, of Newgate-street, London, Tool Maker.]

Figures 1 and 2 of the engravings are external elevations of this wrench. Fig. 3 is a section on the line *ab* of fig. 2. AA, is the fixed jaw which is one piece with the handle, B. CC, is the moveable jaw, the tang of which slides inside the handle, B. D, is a screw spindle which takes into and works in a

* The 3rd voyage was in reality 20 days, as, in consequence of injury sustained by one of the slide valves, she put back into Cork, and lost 14 days.

Fig. 2.

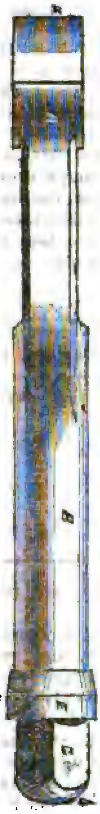


Fig. 3.

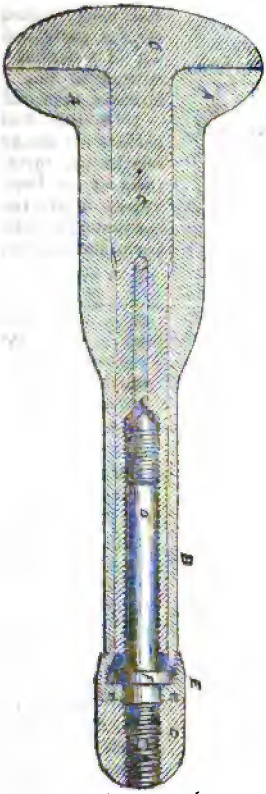
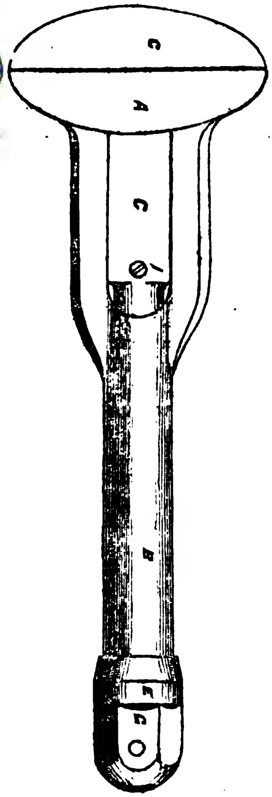


Fig. 1.



female screw formed in the tang of the moveable jaw, CC. E, is a nut which is screwed upon the end of the handle, and keeps the screw spindle, D, in a fixed position by means of the collar, F, and the nut, G, which latter is affixed to the screw spindle by a pin, H. I, is a small screw which prevents the moveable jaw from being altogether unscrewed, and for supplying oil to the screw inside the handle.

By these arrangements the adjustment of the wrench is effected by turning the nut, G, instead of turning the handle itself, and the screw is entirely covered up, so that it is not liable to be injured or become clogged with dirt.

DR. M'SWEENY'S VENTILATING APPARATUS.

Sir,—In the weekly Number in which is given my plan for ventilating a ship by a tube that dips into the sea, the apparatus is represented in a way which, though perhaps geometrically correct, seems to me calculated to mislead the general reader. The end of the tube in the sea seems as if shut; it must, of course, be open to admit the water, and the water in the lower part of the tube must necessarily be on a level with the external water. The place where the foul air should escape from the box seems also as if it were closed, whereas it should be open.

With these exceptions, the woodcut gives an accurate representation of the apparatus, which will be found of great

utility, acting as it does by the motion of the ship. The occurrence in the *Londonderry* steamer has caused a sensation that will not be easily forgotten in the British dominions. Public opinion will not in future permit a number of human beings to be smothered in a ship. The smothering of cattle in ships is bad enough. The Society for preventing cruelty to the Brute creation ought to look to this for the future. They do not permit persons to overwork horses, and surely the gradual smothering of cattle must be one of the most cruel deaths; but the gradual smothering of men—not of rats—but of men, women, and children, all who, before the final struggles, are conscious, at least for some time, of their dreadful situation—this is horrible indeed.

The prompt adoption of the ventilator by owners of ships employed for conveying passengers and cattle, will prevent much suffering, and will protect the owners of such ships from pecuniary loss and litigation. I have no patent for this ventilator, and can have no motive but that of humanity for drawing public attention to it at this favourable time; and I hope that the public press will state its claims for adoption.

Writers in various places, by mooting the subject, will prevent shipowners from pleading ignoranse of a rapid, cheap, and effective mode of ventilating ships. Self-interest ought to produce its usual effects on their minds. Pure air preserves ships—confined air and moisture tend to aid the growth of fungus from the timber. Precautions for the preservation of cattle, and of the timber of ships, by means of ventilation, fortunately will be of service also for *human beings*.

Nothing but culpable negligence on the part of shipowners can prevent the use of this cheap apparatus. In the motion of the ship the tube is at times deeply immersed in the water, and sometimes it is not. When it is, the water forces the air in the tube out through a valve, and the other valve allows the foul air from the ship to get into the tube, through the hose, to replace the water, when the part of the vessel to which the tube is attached rises.

To promote health and comfort among passengers in emigrant ships is desirable. To ameliorate the condition of our fellow men, of every country and of every clime, ought to be a motive with us all.

I am, Sir, yours, &c.

JOSEPH M'SWEENY.

Cork, December 31, 1848.

MEMOIR OF JOHN KAY, OF ROYTON, LANCASHIRE.

Sir,—The following short sketch of one of the most distinguished of Mr. Butterworth's pupils has been drawn up at the request of some of his intimate friends. If you consider it worthy of a place in an early Number of your valuable Journal, its insertion will much oblige.

Yours respectfully,

THOMAS WILKINSON.

Burnley, Lancashire,
January 13, 1849.

JOHN KAY, the son of Thomas and Sarah Kay, was born at Elly Clough, near Royton in Lancashire, on the 16th of July, 1781. When very young he was sent to a day-school in the neighbourhood, but before he had made much progress in his education, he was removed from school, in order to commence hand-loom weaving; which was then not only his father's occupation but the principal employment in the county. During his leisure hours, however, he continued to increase his stock of information, and by the time he was eighteen years of age, was sufficiently qualified to take part in "Discussions," where he frequently distinguished himself by his unusual powers of oratory. About this time he became acquainted with the late John Butterworth, the well-known geometer, who soon perceived the inclination and aptitude of Mr. Kay for mathematical studies, and therefore lost no opportunity of recommending them more particularly to his attention. Under Mr. Butterworth's guidance and assistance, the elementary portions of mathematics were soon disposed of, nor was it long ere the sublimities of the ancient geometry began to attract the attention of his promising pupil. Influenced by the example of his immediate neighbours, Wolfenden, Hilton, and Fletcher, and no doubt biassed by the predictions of his talented instructor, Mr. Kay's ever favourite study, was geometry and its applications. Indeed, he may be said to have devoted almost the whole of his

leisure to these studies alone, for although the subject of mechanics had also its attractions for him, yet most of his investigations in this and other departments of mathematics, have a decidedly geometrical tendency. His first mathematical correspondence appears in the *Gentleman's Diary* for 1808, and exhibits no ordinary degree of elegance and ability. In 1810 he gained the *second* prize awarded annually by the learned editor and proprietors of that valuable periodical, and up to 1816 he continued to enrich its pages with many curious and elegant geometrical and mechanical questions and solutions. Mr. Marrat enlisted his services in the concluding numbers of the *Enquirer*, and in the early portion of the *Leed's Correspondent* his name is also of frequent and respectable occurrence. The *Gentleman's Mathematical Companion* was his favourite publication, and though active business prevented him from contributing so largely as some other correspondents, yet his communications extend, with the exception of a few intervals, from the year 1808 to almost the close of the work. His most profound investigations relate to the subject of Porisms—a branch of the ancient geometry to which he had paid particular attention:—hence on the appearance of the Prize question in the *Companion* for 1823, he produced a solution which gained him the *first* prize, notwithstanding that Gompertz, Simpson, Butterworth, and Epsilon were his competitors.

His contributions to the next Number are remarkably elegant, and the solutions to question 603, 604, and the Prize, merit the highest commendation. He proposed the Prize questions in the *Companion* for 1824 and 1825, the former of which relates to his favourite subject of Porisms, and exhibits the complete command he had obtained of the ancient modes of investigation. This class of propositions has been singularly unfortunate. Confessedly abstruse—*few* have been found sufficiently qualified to grapple with its difficulties, and *fewer still* who have been willing "to contribute their mite to the common stock." It required the persevering energy of Simson to clothe the "dry bones" in the "Collections of Pappus:"—the profound research of Playfair was needed to inspire them with life—and though the labours of Wallace, Brougham, Noble, Galloway, and Davies have done much towards marshalling this "great array," much more appears to be necessary before a successful attempt can be made to carry this stronghold of the ancient geometry. Simson in his day, regretted that the study of geometry was so little cultivated as not to justify the publication of many of his works. (*Davies's* "Geometry and Geometers," No. 2. His most valuable researches would have remained a "dead letter" had not the munificence of Earl Stanhope, in some measure, rescued them from oblivion. Lawson attempted an English translation of the "Treatise on Porisms," but the sale would not warrant the publication of more than sixteen propositions. Playfair promised a continuation of his valuable paper, but no traces of it are in existence, and though the *Repository* and the *Mathematician* have aided the efforts of later geometers, yet even at the present time the publication of a "Translation of Simson's Porisms," with notes, by Mr. Potts, has been postponed *sine die* for want of proper encouragement. Mr. Kay often lamented the neglect of this branch of geometrical science, and contemplated the publication of a work on the subject in conjunction with his friend and tutor, Mr. Butterworth. His predilection for geometry sometimes led him to overrate its powers, especially when applied to mechanics. A curious instance of this may be seen in the solutions to question 399 of the *Companion*, which not appearing satisfactory, led to the solution and remarks on pp. 843—5, *Comp. for* 1819; and to a rejoinder from Mr. Gompertz in pp. 923—4, *Comp. for* 1820. In 1824, Mr. Kay re-proposed the "Flood Gate Question," at the request of his friend Mr. Wolfenden; an able solution appeared in the following number and confirmed Mr. Wolfenden's result by a different process. (*See Mech. Mag.*, p. 466, vol. xlviii.)

At twenty years of age Mr. Kay was elected constable of the township of Royton; an office which he filled for many years with great satisfaction to the authorities. He subsequently became a manufacturer of cotton cloth, and at the time of his decease had been the overseer of the poor of Royton for several years. He died, sincerely regretted by

all who had the pleasure of his acquaintance, on the 31st of December, 1824, in the 43rd year of his age. His remains were interred in Royton church-yard, and the spot where they rest is marked by a plain stone bearing the following inscription:—

In Mathematics soared his noble mind;
Peace robed his soul: he felt for all mankind.
He loved true virtue, but disliked vain pride;
Truth was his aim and Reason was his guide.

Postscript.

The following scrap may not contain the best *poetry* imaginable, but if you consider the *sentiments* worthy of preservation, it is at your disposal.

T. W.

ELEGY.

To the Memory of John Butterworth, the celebrated Mathematician.

Though poor through life, and oft by want oppress'd,
Yet with bright talents Butterworth was blest,
And in chill poverty those talents shone,
Like radiant star beams in the frigid zone.
He was a genius bright, whose leisure time
Was hallowed by pursuits the most sublime;
He soared to abstruse science, and was there
A thing of glory, radiant, rich, and rare.
There, in deep musings he, by reason's light,
With judgment's aid, sought precious truths and bright;
And in his skilful search fail'd not to find
These everlasting diamonds of the mind;
With them he graced the mathematic page,
And with geometry surprised the age.
Though bright in science, yet not there alone—
He glow'd in virtue, in religion shone;
Felt for his fellow-men as all men should,
And rank'd himself amongst the wise and good.
Though scanty were his means, yet he was free,
In soul the very source of charity:
His bounty came not like a summer flower
To grace with flaunting sweets the sunny bower,
But like the Christmas rose, whose humble form
Gives its sweet glories to the gloom and storm.
With cautious step the hallowed path he trod
That leads the Christian safely to his God;
Cheer'd on by virtue, well this course he ran,
And gain'd the prize high Heaven holds out to man.
'Tis finish'd now, the pilgrim 's gone to rest;
But, as the sun leaves glory in the west,
A scene of grandeur he has left behind,
The bright effusions of his radiant mind.

JAMES TAYLOR.

Royton, Oldham, Jan. 3, 1846.

PREPARATIONS FOR CALIFORNIA.

Sir,—I find betting a delusion, money-lending a snare, and railroads an exploded superstition: I am therefore on the point of starting for the gold-digging of California, (a name derived, by the way, from χαλὸς "beautiful" and φόρνια "moonshine,") where, I hope, notwithstanding your correspondent Osig's mean opinion of them, to turn my engineering and mathematical acquirements to some little advantage.

I am, in fact, at present in treaty with the Guardians of an Agricultural Union in the Mediterranean counties, for fifty lads, who are to be bound to me as apprentices for the term of seven years, to learn the art and mystery of gold-digging, and I hope to be off before many weeks are over.

Under these circumstances, I am of course on the look-out for all possible information on the subject of Transatlantic mining; and finding the following passages in a leader of to-day's *Times*, which do not quite chime in with my preconceived opinions, I venture to apply to you for enlightenment and advice.

"Hydraulic rams, Bramah presses, and every kind of engine, with or without steam, were made, shipped, and employed to pump the greedy waters out."

"But rams and presses, though they could drain off water, could not create gold."

Now, Sir, what I want to know, is, whether you would recommend me to take out with me a Bramah press, and hydraulic ram for the purpose of draining my "diggings" in case of their inundation; and if I did take them out, what is the best way of applying them to draining purposes?

To my limited understanding, it seems hardly worth while to fetch the water for a Bramah press, from the bottom of a mine; and if there were a sufficient current of water without one's digging to work a hydraulic ram, I should have thought the best way would be to let it run out unimpeded, instead of forcing a part of it up to a higher level; but of course, you and the *Times* will know best.

I remain, Sir, yours, &c.,

J. E.

January 10, 1849.

P.S. Would not a cheese-press, and a Leicestershire ram, with which my friends, the Guardians, could supply me, answer the purpose as well?

NEW GREAT SEAL OF IRELAND.

It is not often that we have occasion to congratulate that portion of the Irish executive entrusted with the issue of patents on its business-like habits, or Irishmen in general with taking the lead in any matter of practical improvement. In the present instance, however, we have to award to the Dublin officials, the merit of being the first to avail themselves of that very valuable accession to our store of useful substancs—gutta percha. Most people who have had anything to do with patents, are aware that the impression of the Irish great seal has been hitherto made in a sort of wax, offensive both to the smell and touch, and of so brittle a nature as scarcely to bear carriage, and, above all, "used to the melting mood." Instead of this, gutta percha is now used, and with manifest advantage. The gutta percha seal possesses a boldness and sharpness of outline which we have seldom seen equalled even in the choicest medals. We hope to see it soon adopted also for the English and Scottish seals.

REPORT ON THE EXPLOSION OF THE STEAMBOAT, "EDWARD BATES," ON THE MISSISSIPPI RIVER, AUGUST 12TH, 1848, MADE TO THE ST. LOUIS ASSOCIATION OF STEAMBOAT ENGINEERS.

[*Extract.*]

The *Edward Bates* has three double flue boilers, 30 feet in length, and 42 inches in diameter; flues, 16 inches in diameter, all made of iron one-fourth of an inch in thickness, and have been in use only since the 1st of March last. The iron is of a good quality, and the workmanship unquestionable.

The diameter of the safety valve is found to be 3 1/10th inches; the weight of the valve and lever is 132 lbs.; the pea hanging on the lever weighs 109 lbs., and was found attached to the lever at the distance of 13 spaces or leverages from the safety valve; and that the extra lead weight and wrenches attached to the safety-valve line, at the time of the catastrophe, weighed 42 lbs., and were 16 spaces or leverages from the safety valve.

From the above data, it is ascertained that the weight on the safety valve was equal to a pressure of 206 lbs. to the square inch, without calculating the friction of the pulleys over which the line attached to the safety valve was passed.

From the statements of the witnesses, it appears that about 4 o'clock in the morning of Saturday, the 12th inst., when at the head of Westport shute, a short distance below Hamburg, both flues of the larboard boiler collapsed immediately. James Donahoe, chief engineer, and George C. Ambrose, assistant, being on duty at the time. That at the time of the explosion the fires were full; the fire doors and flue caps closed; the doctor and pumps stopped, and a weight on the safety valve equal to a pressure of 206 lbs. to the square inch.

It also appears that, for the last nine miles, the two engines had been worked slow and fast alternately; that steam had been blowing off occasionally while running slow; that the engineer told the firemen to shove up the fires, and that the safety valve was shut down twice within a few minutes previous to the explosion, and that "*the last time he shut it down, the accident happened,*" to use the language of the assistant.

From a particular examination of the flues, after the collapse, it appears that the rivets, where the sides have been forced together in several places, have made indentations plainly discernible on the outsides of the flues, from which fact, as well as from the peculiar shapes into which the flues are warped and twisted, it is plainly indicated that a portion of the flues were red hot at the time of the explosion.

From all these circumstances, the following conclusion has been unanimously arrived at, that the disaster was caused by the water being too low in the boiler, and by the unusual head of steam accumulated by overloading the safety valve, increasing the fires, and shutting off the supply of water from the pumps; and *that these causes are to be attributed to the recklessness or imprudent management of the chief engineer on duty.*

The time that elapsed between the moment the doctor was stopped and the explosion, is stated by the only witness who was aware of the fact, to be about one minute. This may be true; and if so, it only goes to prove that the best boilers cannot be trusted even that short period of time without a proper supply of water to keep the flues covered, and preserve them from the action of the fires beneath.

If the boat was "in the habit of rolling very much," as represented by the assistant engineer, then it would have been the duty of an engineer to have closely watched the water in the outer boilers, and if he found it scant, he should not have had such heavy fires as were evidently under these boilers at the time of the collapse.

The pilot and assistant engineer express the opinion that the boat was trim at the time of the explosion, but the position of the flues as found by your committee does not corroborate this statement. The committee found the collapsed flues lying in an oblique position, with their tops leaning to the larboard side, and their bottoms to the starboard side of the boiler, thus clearly indicating by their position, in the minds of your committee, that the boat was careened to the starboard when the explosion took place.

This Association has repeatedly asked of Congress the passage of a law restricting engineers to the amount of pressure that should be carried on boilers on board of steamboats, but have thus far failed to effect so desirable an object. Had a law of this kind been passed, with proper and adequate penalties, the design of the Association could have been fully carried out, and thereby have amply secured to those travelling on our western waters their lives and property.

MATTHEW KIRTLEY, DERBY, ENGINEER, *for certain improvements in the manufacture of railway wheels.* Patent dated July 11, 1848.

Claim.—Forming bars of iron, by rolling, with angular ends, suitable for the spokes of railway wheels.

JESSE ROSS, LEICESTER, AGENT, *for improvements in apparatus for dibbling and other agricultural purposes; part of which improvements are applicable to propelling vessels.* Patent dated July 11, 1848.

Claims.—The combination and arrangement of mechanical parts in a dibbling and sowing apparatus, whereby both operations are effected at the same time. 2nd. The arrangement and combination of several of these apparatuses in a frame, to be drawn by horses, and in connection with cranks and toothed gearing, so that they are alternately plunged into the ground where they deposit the seed, and lifted out, the earth being filled in afterwards by any suitable means. 3rd. The application of the preceding mechanical arrangement, for raising and lowering the dibbling apparatuses to the propulsion of vessels by causing a series of vertical paddles, placed on either side of the vessel at the bow and at the stern, to be thrust into the water, drawn backwards, lifted out and brought back into their original positions. And, lastly, causing the paddles to feather when they are no longer acting against the water.

FELIX ALEXANDRE TESTUD BEAUREGARD, Paris, engineer. *For improvements in generating steam, and in the means of obtaining power from steam engines.* Patent dated July 11, 1848.

No claims are given in this specification, nor any distinct and clear statement of what the "improvements" are which the inventor claims—a defect which has before now proved fatal to many a patent. What the subject of M. Beauregard's invention is we know well, for we gave, a good while ago, a full description of it in our pages (vol. xlix., p. 411,) translated from *La Presse;* but we are here speaking of it as legally presented to the judgment of the British public, in fulfilment of the conditions imposed upon the inventor by the terms of his patent. It is based, as our readers may remember, on the remarkable phenomena attending fluids in a spheroidal state, discovered by M. Boutigny, and noticed repeatedly in the pages of this Journal. The invention was investigated and favourably reported upon by a committee of the *Societé d'Encouragement,* and was regarded by many eminent engineers as a most ingenious application of a novel and important fact in the generation of steam. Strong doubts were nevertheless entertained and expressed by some, which it was expected the specification would go far towards removing. We regret to say that it will do nothing of the kind.

It is altogether a most unsatisfactory affair, owing, apparently, to some want of mastery of the subject on the part of M. Beauregard himself, but more, to ignorance of our language, idioms, and forms, and to gross incapacity on the part of those who have undertaken to be his interpreters on this occasion. M. Beauregard is in the case of a man of weak sight trying to see better through bad spectacles. He is made by his translator to say, that his "machine" consists of certain "*principles,*" though no "machine" is mentioned in the title, and "principles" in any shape, are notoriously not patentable matters. Again, we are told that "the phenomena presented by bodies in a spheroidal state, *is* the basis" of his invention, and that he employs what he terms indiscriminately "chloric de calcium," "chloric of calcium," "chloris of calcium," and "chloride of calcium calcinè." Of blunders such as these there is no end; and, what is worst of all, no person of ordinary information and ability, supposing he were able to grope his way through the bad English, bad grammar, and bad translation in which it abounds (of all which the law would take a charitable cognizance), could tell from the specification, without the aid of lights from other quarters, (such aid as the law will on no account admit of) what the "nature of the invention" and "the manner in which it is to be performed" really are.

JEAN LOUIS LAMENAUDE, formerly of Passage Jeoffroy, Paris, now of 315, Oxford-street, London. *For a new process of applying or fixing letters of metal upon glass, marble, wood, and other substances.* Patent dated July 18, 1848.

The letters—which may be cut out of thin metal, or made by electro-deposition, and, if preferred, may be gilded by electro-deposition, or have enamelled surfaces produced upon them—are affixed to the surfaces above-mentioned by the following compositions or mixtures:—15 parts of copal varnish, 5 parts of fat oil ("say linseed oil litharge, commonly called drying oil"), 3 parts of oil of turpentine, 2 parts of essence of turpentine, 5 parts of animal glue, dissolved in a water-bath, and 10 parts of hydrate of lime. Or, 15 parts of sandarac and galipot resin varnish, 5 parts of drying oil ("linseed oil litharged"), 5 parts of oil and es-

sence of turpentine mixed, and 5 parts of marine glue; these ingredients are mixed, and then 10 parts of Spanish white and dry white lead are added. Or, 15 parts of copal varnish and gum-lac mixed, 5 parts of drying linseed oil, 3 parts of a solution of India-rubber or gutta-percha, 7 parts of oil of tar, and 10 parts of Roman cement and plaster of Paris, in powder mixed. Or, 15 parts of copal varnish and colophane, resin, 5 parts of oil and essence of turpentine, 2 parts of isinglass in powder, 3 parts of iron filings sifted, or blacksmiths' cinders, and 10 parts of washed earth, or ochre, or rotten-stone.

Claim.—1. The securing or fixing thin metallic letters on glass, marble, stone, porcelain, wood, metal, crystal, or any other hard and smooth surface, without the use of metallic fastenings. 2. The making thin letters of metal, and coating them with an enamel surface of any colour; also letters made by the electro-galvanic process, or letters gilded by the electro-galvanic process, and of fixing the same by the compositions herein named. 3. The compositions, named in this specification, as applied to affixing letters on the surfaces of the within-named materials. 4. The various materials in these compositions, with the solvents, in any proportions, as applied to the purposes of affixing letters on the polished surfaces of the material herein named. The 3rd claim is inconsistent with the title of the patent, which is for "the process of applying and fixing" only.

William Edward Hollands, 73, Regent's-quadrant, dentist, and Nicholas Whitaker Green, 15, Walton-place, Chelsea, gentleman. *For a new manufacture of artificial fuel in blocks or lumps.* Patent dated September 4, 1848.

This invention consists in the manufacture of artificial fuel into lumps or blocks by employing plaster of Paris, caustic cements and water, combined with small coal, and with or without other materials, in order that the cementing matters of the caustic cement, and the hardening character of the gypsum may set, crystalise, and hold the small coal in concrete masses. And when the lumps of coal are liable to become friable and decrepitate by exposure to the atmosphere, in coating their surfaces with oil. When it is desired to produce a fuel easily inflammable, it is proposed to mix with the substances before named any salt containing a large quantity of oxygen, such as nitrate of soda, or potash, or chlorate or chromate of potash; or instead of these, when the fuel is to burn slowly, alum is to be substituted, and when it is to burn brightly, rock or common salt.

The mode of manufacturing this fuel consists in mixing up the following substances in the same manner as mortar, and in the proportions by weight annexed thereto respectively; calcined gypsum 140 parts, caustic lime 17, ground alum 17, aluminous clay 28, small coal 2240, with the requisite quantity of water. This mixture is moulded into suitable lumps or blocks, which are afterwards dried, and when dried, dipped in, or brushed over with linseed or other oil.

Claims.—The employment of gypsum, caustic lime, or other caustic cements before mentioned, combined with water and small coal, with or without other materials, to produce concrete blocks or lumps of artificial fuel; and coating the surfaces of these lumps with oil.

Richard Roberts, Globe Works, Manchester, engineer. *For certain improvements in and applicable to clocks and other time-keepers, in machinery or apparatus for winding clocks and hoisting weights, and for effecting telegraphic communications between distant clocks and places otherwise than by electro-magnetism.* Patent dated July 11, 1848.

The specification of this invention, which occupies eighteen skins of parchment and eight sheets of drawings, is of such great length, and of so complicated a nature, as to prevent us from devoting to it more of our space than is sufficient to give the claims, which are as follows:—

1. An arrangement and combination of apparatus whereby tidal power is rendered applicable in effecting the motion of clock-work and other machinery.

2. An arrangement for driving the striking and going hand from one spring or weight, and for overcoming the difficulty of the guide pulley in turret and other clocks.

3. A mode of causing the time indicated upon the dial of one clock, to be indicated simultaneously upon a number of dials placed at a distance; and its application to purposes of telegraphic communication.

4. An arrangement for imparting equimotive impulses to timekeepers.

5. A method of causing the hand or index to move a distance corresponding to the number of oscillations of the pendulums.

6. A combination whereby pocket and box chronometers are made to beat dead seconds.

7. An arrangement for recording the duration of an occurrence without interfering with the other movements of the timekeeper.

8. Certain improvements in the compensating balances of chronometers.

9. A cycloramic dial. (The dial and hand both transparent.)

10. The employment of toothed sectors for effecting striking in clocks.

11. A chronometer with equimotive escapements, whereby its mechanism is made to act with greater accuracy.

12. A mode of hardening and manufacturing the dials of time-keepers.

13. A "normal drill."

14. A gauge for ascertaining the sizes of the different parts of time-keepers.

Joseph Stenson, of Northampton, engineer. *For improvements in steam engines and boilers, parts of which improvements are also applicable to other motive machinery.* Patent dated July 18, 1848.

Claims.—1. The rotary engine, as described in the peculiar arrangement and combination of parts of which the same consists (but without claiming any of them individually and separately); and also three several modifications thereof.

2. An improved rotary emission engine, as described, in so far as regards the employment therein of two steam wheels, one attached to and revolving with the axis, and the other turning freely upon it. And in so far also as regards the indenting of the inner faces of the edges of the wheels.

3. An improved oscillating engine, as described, in so far as regards the cross-head, D, and a frame in which it slides.

4. Several improved methods of constructing boilers represented in drawings from fig. 13 to fig. 36, both inclusive, and as described, in so far as regards the increased amount of fire and flue surfaces obtained in each case, and the peculiar arrangements by which such increase is effected.

5. A self-acting damper, as described.

6. An arrangement for heating the feed-water of condensing engine boilers, as described.

7. An arrangement for facilitating the condensation of the exhaust steam in condensing engines, as described.

8. The employment in locomotive engines of two boilers, placed and connected as described.

9. An arrangement whereby the steam issuing from the boilers of locomotive engines, is caused to pass through a case placed within the smoke-box, before passing to the working cylinder, as described.

10. An improvement in gauge-cocks, as described.

11. A mode of strengthening steam pipes by tension rods, as described.

12. An improved cooking apparatus, as described, in so far as regards the boiler and the parts immediately connected therewith and dependent thereon.

13. The employment of steam engines to work from a distance threshing and other agricultural machines through the medium of condensed air and emission wheels (or other equivalent machinery), as before described.

14. The adaptation of emission and other steam engines to the obtaining of electric light from steam, in manner described. And

15. An arrangement whereby the air-pump may be dispensed with in condensing engines, or at least used of much smaller dimensions than usual, as before described.

[Several of these improvements seem to us of great value, and in a future Number we shall give a full account of them.]

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal.*]

For an Improvement in the Steam Hammer. *Lewis Kirk.*

The nature of this invention consists in so combining a steam engine with the helve or lever of a hammer, and between the hammer and fulcrum, that when the steam is let in under the piston it shall lift up the hammer, and when the exhaust valve is opened, the piston will be at liberty to be carried down by the weight of the hammer, the steam and exhaust slide valves being operated each by a separate arm, on the shaft of the helve or lever, and the ends of these two arms being so connected with the valve rods, by slots, which permit the arms to move for some distance before they begin to act on the valves, so that the hammer shall nearly reach the end of its downward motion before the steam valve is opened, to admit steam to produce the next upward motion; and so of the exhaust valve during the upward motion of the hammer, the admission of steam to the steam valve being governed by a slide valve, that commands a steam port in a plate immediately above the steam valve, and operated by hand, by means of which the attendant can start and stop the hammer at any time, and at any portion of its motion. And the invention also consists in combining with the hammer, thus operated, a slide plate with a port in it, under the steam valve, and a like plate under the exhaust valve; so that the attendant can, by sliding these plates, by a screw or lever, cause either the steam or exhaust valves to open or close, sooner or later, and thus regulate the length of stroke of the hammer.

Claim.—"What I claim is the arrangement of the vertical single acting steam

engine, substantially as described, when this is combined with the helve or lever of the hammer, by means of the rocker on the cross-head, and the jointed links, substantially as described. Also the sliding plates, or regulating valves, below the steam and exhaust valves, in combination with the engine, combined with the hammer helve or lever, substantially as described, whereby the range of motion of the hammer can be increased or decreased by the attendant, at pleasure, as described."

FOR AN IMPROVEMENT IN THE MANUFACTURE OF GAS. *Benjamin F. Coston.*

Claim.—"The employment of a retort, with the vertical branch containing the material for presenting heated surface to the rosin and tar or other substance to be gasified as it descends from the reservoir, as described, whereby the required surface is obtained to insure the production of gas with economy, and by which also the substance or substances from which the gases are to be produced is compelled to pass over and around the heated surfaces.

"*Second.* Placing the reservoir or vase of crude material above the vertical branch of the retort, and combined with the stove or furnace as described, and connecting the retort and vase by means of a pipe which opens from one into the other as described, by means of which arrangement the weight of the column of rosin and tar in the reservoir aids in forcing down the crude material into the vertical branch of the retort to prevent choking, at the same time employing the heat of the furnace which surrounds the retort to keep the rosin, &c., in the reservoir in a liquid state.

"*Third.* Combining the neck of the retort with the cooler, by extending this vessel (the cooler) entirely around the neck of the retort, and keep its temperature down to the boiling point or below, and thus prevent the tar, &c., from baking in the neck of the retort.

"*Fourth.* The method of regulating the supply of crude material to the retort by the consumption of gas by combining the hood of the gasometer with the cock or valve of the supply pipe through which the crude material passes to the retort, in the manner substantially as described, whereby the cock or valve is opened by the descent, and closed by the rising of the hood.

"And, lastly, the method of condensing and washing the impurities from the gas, by combining with the gas pipe a condenser provided with a sieve for the spray of water and the bent-up pipe for the discharge of the condensing water and impurities, without permitting the escape of the gas."

FOR IMPROVEMENTS IN THE HYDRAULIC RAM. *Joshua L. Gatchel.*

Claim.—"What I claim as new, is the employment of the weighted elastic diaphragm, in combination with the descending pipe, leading down into a well or other reservoir of pure water, from which a portion will be raised at every impulse of the ram. I do not claim the use of a flexible diaphragm in apparatus for raising water, but I do claim it as making a part of the combination necessary to the raising, and the preserving unmixed, of the pure water, under the arrangement set forth.

"I also claim, in combination, the particular manner of constructing the impulse valve, with the regulating plate, and the holes bored obliquely through the rim of the valve, in the manner and for the purpose set forth."

FOR AN IMPROVEMENT IN RAILROAD BRAKES. *John Lahaye.*

The patentee says,—"The nature of my invention consists in so constructing the brakes, that a reversed motion of the wheels of the car will throw them out of gear, and prevent their acting on the wheels while the cars are moving in a backward direction."

Claim.—"What I claim is the combination and arrangement of the rubbers or brakes, the rubber cases or shoes, joint pieces and bolt, with each other, and with the shaft, cams, lever, bar, and bumper, substantially in the manner and for the purpose herein set forth."

FOR AN IMPROVEMENT IN PREPARING AND COMPOUNDING CAOUTCHOUC OR INDIA RUBBER. *William F. Ely.*

This improvement, "consists in the treatment of the compound of calcined magnesia, or the carbonate of magnesia, and India rubber, by submitting the compound thus formed, to the action of heat or steam at a regular temperature, by which exposure of such compound to heat, it will be so far altered in its qualities, as not to become softened by the action of the sun, or of artificial heat, nor will it be injuriously affected by exposure to cold. It will lose the adhesiveness of India rubber; it will also, in a great degree, resist the action of all the known solvents of rubber."

Claim.—"What I claim is the combination of calcined magnesia, or the carbonate of magnesia, with India rubber, when the fabric is cured by the heating process, and in combination therewith, so as to form a new fabric, with a compound, either in the proportions above named, or in any other, within such limits as will produce a like result."

For an Improvement in the Manufacturing Wire Ropes. *John A. Roebling.*

Claim.—" 1. The process of giving to the wires and strands a uniform tension, by attaching them to equal weights, which are freely suspended over pulleys during the manufacture as above described.

" 2. The attaching of swivels, or of pieces of annealed wire, to the ends of the single wires, or to the several strands, during the manufacture of a rope, for the purpose of preventing the twist of the fibres, as described above.

" 3. The manner of constructing the wrapping machine, the head of the hull, around which the iron bar revolves by means of its collar, embracing the wire rope firmly, and bearing against the wire, which is being wound upon it; said bar bearing against the face-plate of the reel, for the purpose and in the manner herein shown, and the respective parts of which are combined and arranged as above described, so as to adapt it to the particular purpose of winding wire upon wire ropes."

For an Improvement in Building and Propelling Vessels. *Thomas L. Jones.*

Claim.—" 1st. Arranging the paddles on the transverse revolving cylinders (placed transversely under the vessel,) in series of reversed spirals, as described, so that the current of water thrown by the series on one end shall be met and thrown back by the series on the other end, whether the two series be arranged on one cylinder, or on two cylinders upon the same shaft.

" Also the mode of steering the vessel, by means of the fore and aft, or first and last cylinders in the series, or either of them, the same being made moveable, and caused to traverse, for the purpose and in the manner set forth, or in any other substantially the same."

For an Improvement in the Self-Acting Safety Gauge for Steam Boilers. *John A. Roebling.*

Claim.—" The application of a lever, which may be in the shape of a hammer, the head of which rests on the surface of fusible metal, which is contained in a box, and secured upon the top of a flue, so that when the water in the boiler sinks too low, and exposes the alloy, this will melt readily from the heat of the flue, and allow the hammer to sink, which then, by its leverage, will open a gauge, and give alarm by the escape of steam."

For an Improvement in Spark Arresters. *Samuel G. Brown.*

Claim.—" The method of extinguishing sparks by means of cylindrical or circular screens, fixed and made to revolve in smoke flues, so constructed as to contain each a portion of water, or cabonic acid gas, into which a part of the screen is immersed, as above described; also the method of producing or increasing the draught in furnaces, flues, and stacks, by exhausting them of heated air, smoke, &c., by means of pumps, as herein described; also the making of apertures in the lower, or bottom part, or parts, of the cylinders of said exhausting pumps, which apertures lead into boxes or chambers, attached to their cylinders, into which the ashes, &c., that settle in said cylinders, will, by the action of their pistons, be caused to pass."

For an Improvement in the Process and Apparatus for the Treatment of India Rubber Fabrics. *C. J. Gilbert and Gamaliel Gay.*

Claim.—"*First*, the method of seasoning raw India rubber or caoutchouc, or extracting therefrom what is called the " sap," by subjecting it to the action of dry or moist artificial heat, separately or together, whereby the raw India rubber may be thoroughly seasoned, and the sap therefrom extracted, in a much shorter time than by exposing to th action of the atmosphere, as described.

" *Secondly.* The method of heating, curing, or drying India rubber fabrics, made of any compound of which rubber is the basis, by subjecting them to the combined action of dry heat and steam, whereby the steam is prevented from condensing on the surface of the fabrics, and injuring the surface and lustre thereof, and whereby a more perfect surface is produced than when subjected to either dry heat or steam, separately as described.

" *Third.* Submitting India rubber fabrics to the action of the fumes of sulphur, or sulphurous acid gas, preparatory to the curing or drying process, instead of incorporating the sulphur with the rubber, or spreading it on the surface.

" *Fourth.* Passing a current of air over the surface of India rubber fabrics, for the purpose of removing the peculiar clammy feeling left on the surface of these fabrics after the drying process, and which has heretofore been effected by exposure to the solar rays.

" *Fifth.* The vertical cylinder in which the above processes are carried on, in combination with the moveable frame to which the fabrics are suspended.

" *Sixth.* The method of heating the cylinder which contains the fabric in combination with the method of introducing steam therein, as described.

" *Seventh.* In combination with the vessel that receives the fabrics, the tube for the circulation of air, the two ends of which

connect with the said vessel, when the said tube is provided with a blower or other apparatus for inducing the current of air through it, and made to pass through a heating apparatus, as described.

"And, finally, in combination with the cylinder and tube, the means of introducing gases or fumes in the said tube, to be conducted to the fabrics in the cylinder."

WEEKLY LIST OF NEW ENGLISH PATENTS.

Richard Laming, of Clichy la Garonne, near Paris, France, chemist, for improvements in the modes of obtaining or manufacturing sulphur and sulphuric acid. July 13; six months. N.B.—This patent being opposed by caveat lodged at the Great Seal Patent Office, was not sealed till the 13th January, 1849, but bears date the 4th September, 1848, the day it would have been sealed and dated had no opposition been entered (by order of the Lord Chancellor).

William Betts, of Smithfield-bars, London, distiller, for a new manufacture of capsules, and of a material to be employed therein, and for other purposes. January 13; six months.

George Williams, of Tipton, Stafford, forge manager, for a certain improvement or improvements in preparing puddling furnaces used in the manufacture of iron. July 13; six months.

Conrad Haverkam Greenhow, of London, civil engineer, for certain improvements in atmospheric railways. January 13; six months.

Richard Dugdale, of Brompton, Middlesex, engineer, for improvements in hardening articles composed of iron. January 13; six months.

Anthony Barberis, of Leicester-square, engineer, for improvements in spinning silk, and in the construction of swifts, and in the arrangement of apparatus for winding silk and other fibrous substances. January 16; six months.

Jean Baptiste Francois Maseline Cline, of Havre, France, engineer, for improvements in steam engines, and in the machinery for propelling vessels. January 16; six months.

William Martin, of St. Pierre les Calais, France, mechanist, for certain improvements in machinery for figuring textile fabrics, parts of which improvements are applicable to playing certain musical instruments, and also to printing, and other like purposes. January 16; six months.

Peter Augustine Godefroy, of London, chemical colour manufacturer, for certain improvements in dressing and finishing woven fabrics. January 16; six months.

Edward Buchler, of London, merchant, for improvements in the manufacture of boots and shoes, also applicable to other fabrics. January 16; six months.

Carey M'Clellan, of Larch Mount, in the liberties of the city of Londonderry, for an improved corn mill. January 16; six months.

James Hamilton, of London, civil engineer, for improvements in cutting wood. January 18; six months.

John Francis Bottom, of Nottingham Park, Nottingham, lace dresser, and John Dearman Dunnicliff, of Hyson Green, Nottingham, lace manufacturer, for improvements in dressing or getting up fabrics of cotton or silk, and of cotton and silk combined. January 18; six months.

Francis Alton Calvert, of Manchester, mechanist, for certain improvements in machinery for cleaning and preparing cotton wool and other fibrous substances. January 18; six months.

Thomas Newcomb, of Bermondsey, machinist, for improvements in furnaces. January 18; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Jan. 12	1729	Isaac Moses, trading under the firm of E. Moses and Son.	Minories, London	The Sternophylon, or shirt and chest protector.
,,	1730	Charles Otto Wilckens and Richard Hesse	James-street, St. Luke's	Compound wrench.
13	1731	John Young	Wolverhampton	Lock.
,,	1732	George Dudley Ryder,	Grace Dieu Warren, Leicester	Double bow suspension spring for carriages.
,,	1733	Charles Rickets	Agar-street, Strand	Economic gas cooking stove.
17	1734	Josiah Evans	Warrington	Steam valve.
,,	1735	Thomas Nash, Jun.	Southwark	Painters' brush.
18	1736	Charles Otto Wilckens and Richard Hesse	James-street, St. Luke's	Marginal seal stamp.

Advertisements.

NOTICES TO CORRESPONDENTS.

A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the Claims of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week, up to the time of going to press. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d. Post-office Orders to be made payable at the Strand Office, to Joseph Clinton Robertson, of 166, Fleet-street.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co. Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

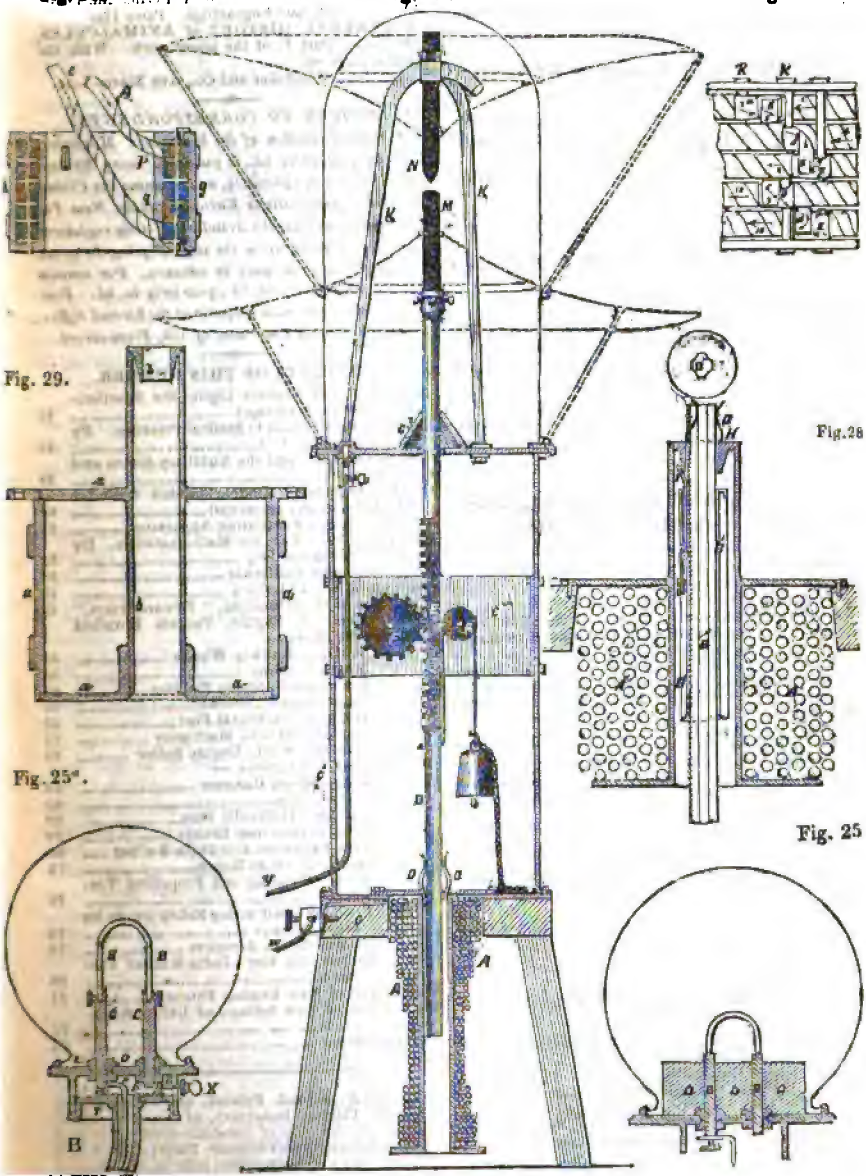
No. 1329.] SATURDAY, JANUARY 27, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

STAITE'S PATENT ELECTRIC LIGHT.

Fig. 30. Fig. 27. Fig. 31.

Fig. 29. Fig. 28. Fig. 25a. Fig. 25



STAITE'S PATENT ELECTRIC LIGHT.

[Concluded from page 58.]

Another improvement consists in the employment of iridium as an electrode, which is especially suitable for smaller lights. Iridium being, of all known metals, the hardest and most intractable, will bear an excessive degree of heat without fusing. To adapt it for electrodes, I prepare it as follows:—I fuse oxide of the metal in a cupel of bone-ash, under the voltaic arc, by which means it is brought under the action of the most intense heat with which we are acquainted. Having obtained an ingot of the metal, I submit the same to the constant action of heat for the purpose of annealing it; and for this purpose I use one or more large jets from an oxyhydrogen blow-pipe. When the ingot is at a white-heat, I pass it between rollers, or hammer it, repeating the process again and again, until the metal is sufficiently annealed to be worked up into the required shape. Sometimes I mix platinum with the iridium, and sometimes copper, in small quantities, which facilitates the annealing. Sometimes also I cut it into thin strips from the ingot, in the same way as precious stones are cut by the lapidary. For lighting purposes, I use either a thin strip of the iridium, so prepared and cut off, or a combination of iridium with platinum, or of iridium with copper, or a spiral coil of the iridium instead of a solid electrode. Platinum strips and platinum wire have been used before, and are well known; but iridium so prepared has never, to the best of my knowledge, been before used for the purposes of lighting.

To increase the temperature of the metallic electrode, A^1, I sometimes pass the metallic holders, BB, through a block of glass, DDD, or some other similar bad conductor of heat, as represented in fig. 25, so that the heat and radiant light may be developed with as little loss of the former as possible by radiation.

An elevation of a small iridium bracket lamp is given in fig. 25^a and 25^b. A^1 is the electrode of iridium, which is fused on or otherwise fixed to two pieces of platinum, BB, which are fixed into two copper or other metallic holders, CC. These holders are insulated by means of ivory, wood, or vulcanized India-rubber washers, DD, or some other suitable non-conducting substances, so as to prevent contact with the bottom metal plate of the lamp, E. To one of the metallic holders a copper wire, a^1, passing through the hollow tube, B^1, is connected with one pole of the battery, and the electric circuit is completed, and the current made to pass through the brass-work of the lamp to the electrode, by turning the ivory knob, X, which is attached to a screw-shank, Z, making a metallic communication with the other holder. The second wire from the battery may be attached to any part of the lamp or socket, as, for instance, by a binding screw. W Y is a ring of brass, which is screwed into the bottom of the lamp. A glass shade, of any shape or form, may be placed on the plate, E.

Fig. 26 represents a triple electrode suspending lamp. Each electrode is independent of the others, and insulated as before. A battery for working this lamp is divided into three parts, one for each electrode. One wire for the return current (which may be fixed to the lamp, or any part of the metallic tube by which it is suspended) is sufficient for all three electrodes; but each electrode is rendered luminous by completing the circuit of that particular electrode, as before described. AAA, fig. 26, are three ivory knobs, with metallic shanks, for making the necessary communication, as before described.

Eleventhly. My invention consists of certain arrangements for producing a regularly intermittent light from electricity, which are especially suitable for lighthouses, and may also be applied to other purposes. An apparatus embodying the chief of these arrangements is represented in fig. 27. The parts in this apparatus which are similar to those in the permanent light apparatus, figs. 21 and 22, before described, are indicated by similar letters. A helix coil of insulated copper wire, A, is employed for the purpose of producing the prime moving force which actuates the sliding shaft which holds the electrode. This helix is fixed to the bottom of the framework, C C′ C″. It is of nearly the same construction as the regulator coil before described, only it is a little longer, and instead of being used to regulate the occasions and degree of action of some other moving force, it produces the moving force itself, and the number of concentric coils of wire varies at different parts of its length. A cylinder of soft iron, B, moves freely up and down in it; to the top of B is fixed the rack, E, which slides through the hole at c'', and carries the electrode, M, fixed in a socket, so that this shaft can move the electrode, M, to or from the lower end of the electrode, N, which is fixed in the top of the tripod, K, by wedges or screws. K is fixed and furnished in the same manner as that shown in fig. 21, and before described. The weight of the shaft, B E, is rather overbalanced by the weight, Q, which is attached by a string passing over a pulley,

R, to B. A pinion, F, works into the rack, E, and fits it loosely with a back lash of about a tenth of an inch. Or, instead of this, the pinion may fit loose around its spindle, which may have a key or feather fixed on the spindle working loosely (to the extent of an arc one-tenth of an inch at the circumference) in a keyway in the pinion. The pinion, F, is connected with an ordinary train of multiplying wheel-work (concealed behind the brass plate, c''') and terminating by any well known sort of fly or escapement motion of such kind, that F, Y, will be prevented from revolving quickly, but will at the same time yield with a slow motion to any slight force from the rack, E, so as to prevent the rack E, from moving up or down too quickly. The negative wire from the galvanic battery is connected with one end of the helix coil, A, and the other end of it is soldered to the brass case, so that the current passes through the helix wire to its case, and thence by means of the springs D, which are fixed to the case, and are in contact with the iron cylinder, B, up the shaft, D, E, to the electrode, M, whence it flows through N, down K, and returns to the positive pole of the battery, by means of the wire *y*. But when the current thus passes the helix, A causes the shaft B to be drawn downwards, which motion separates the two electrodes, M, N, and light is evolved until the electrodes become too far separated when the current suddenly ceases, the light becomes extinguished, and the helix ceases to draw B downwards, when the weight, Q, begins to draw it upwards again, until the

Fig. 32.

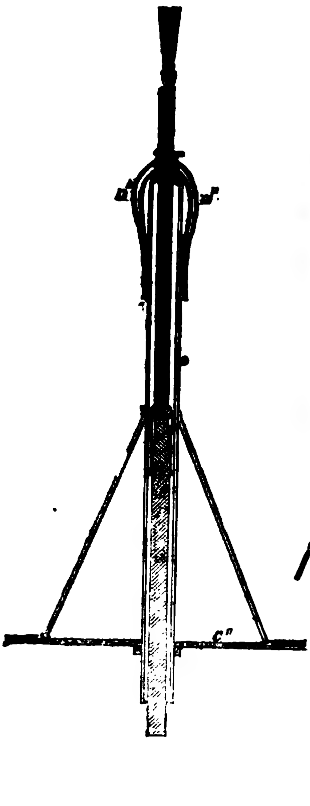


Fig. 33.

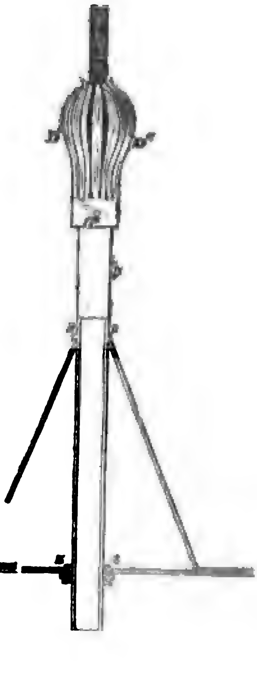
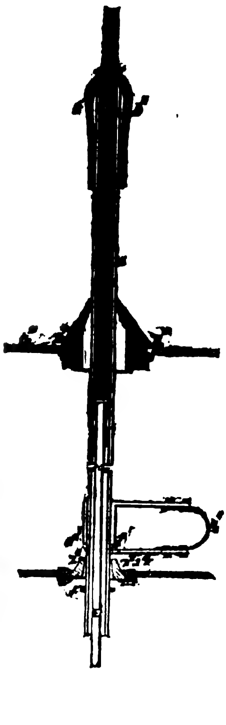


Fig. 34.



electrodes touch one another, whereby the electric current is re-established, and the light is repeated as before.

The slow gear and pinion motion used in the above apparatus may be dispensed with, and then it will produce a series of flashes of light at shorter intervals. Or, instead of the pinion fitting the rack with a back lash, or being loosely keyed on the spindle, it may be placed on its spindle so as to revolve freely upon it, with the addition of a circular rack on the side, or in the central hole of the pinion, with a spring ratchet fixed to the spindle in such position as to work into the said circular rack. An opposite arrangement of rack and spring ratchet will cause the pinion to move quickly in one direction (for the electrode shaft, E, to move downwards,) without the spindle turning with it, and the ratchet will prevent the reverse motion from being made quicker than the slow motion gear will admit of. This will cause brief flashes of light with intervals of darkness of any desired duration. Or, thirdly, the electrode shaft may work two pinions, each working in a separate rack on opposite sides of the shaft, or both on the same rack, each of them turning freely on their spindles in one direction, and the direction being different with each, each too being caught and made to turn its spindle with it when turned on its opposite direction. These pinions are each connected with a separate (or partially separate) slow motion gearing, as before described. This will make both the flashes and the intervals of darkness to be of any desired duration.

These intermittent lights are convenient applications of the electric light when it is desired to have an apparatus requiring little expense and attention, partly because by this arrangement an electrode of moderate length may be made to last a long time; an especial advantage this, when the light is fixed on a stand,—upon a rock, for instance, at some distance from any spot on which a lighthouse of the ordinary description could be built, and where, consequently, the battery is on shore, or at a considerable distance, and communicates with the lamp by means of wires insulated after the manner of submarine telegraph wires, and buried in the sand or cemented between the rocks, and where, with this arrangement, the lamp itself may be difficult of access in stormy weather, and require to remain in a good working state without new electrodes for some days together.

The apparatuses which have been described, fig. 27, may be modified in manner following, as to produce also a good permanent light. The helix, A, may be made sufficiently powerful (more so than is necessary for the intermittent light), and the weight be so adjusted, that it shall be balanced by the force of the helix acting on B, just when the electrodes are not so far apart as to endanger the continuity of the light, nor closer together than about one quarter of the diameter of the lower electrode, M. A chain is hung from the weight, Q, at its end resting loosely on the stand, C, and this chain is equal in weight to a similar length of the electrode, M, so that as the electrode wears away, the diminution of weight is just compensated, and the weight of the shaft remains properly balanced. In this modification of the apparatus, the rack and its slow-motion pinion are made to work smoothly together without any "back lash" or looseness of pinion on its spindle.

Another means of modifying the said apparatus, fig. 27, to produce a permanent light, is to fix a regulating coil with a properly weighted iron centre, &c., just like that described in fig. 21, (at R, *o*, *p*, *x*, *y*). This coil is fixed to *c*, fig. 27, and its wire is permanently included in the electric current; and O, instead of P, moving a ratchet, V, V; when it drops, it presses a spring, or lever in connection with the negative wire from the battery in contact with the shaft, B, so that most of the electric current passes from the negative wire through the lever to B direct, and B is no longer drawn down by the action of A, but begins to rise by the force of the weight, Q, which in this modification of the apparatus is made to overbalance the shaft as it does in fig. 27. Hence this arrangement will preserve the electrodes from approaching too near, or receding too far, while the electric current is continued in action.

The apparatus employed, fig. 27, in any of the preceding modifications may be made to act by substituting the arrangement shown in fig. 28, for the parts A and B, which gives a greater moving power, and allows the electrode shaft to move through a long space not limited by the length of the coil, A. A′, fig. 28, is a helix coil, similar in construction to A, but differing in form, as is indicated in the sectional view, fig. 28. A short hollow cylinder, B′, is substituted for B; a brass rod, B″, (or a bar "feather edged," for the sake of lightness,) passes freely through B′, and ratchet teeth are cut in it as shown, by which a spring ratchet, *g*, suspends B′, in the position shown in the engraving. An end, H, which screws on to the top of the central tube of the coil, A, carries the conducting springs, D D, and guides the shaft, B″, when the shaft, B″, rises (carrying B′ with it) it brings the projecting end of the ratchet, *g*, against the slanting side of H, the pressure of which

pushes the ratchet out of the teeth and lets B′ descend for the space of one notch or

Fig. 26.

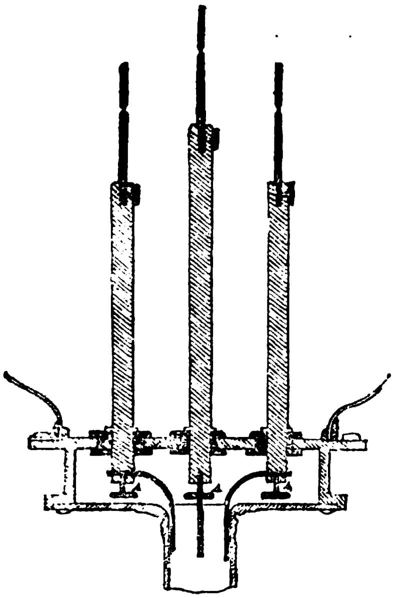
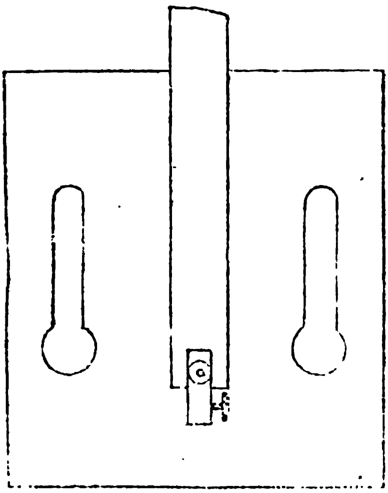


Fig. 25b.



tooth, so that B′ is always ready when the current in A′ acts to draw the shaft, B′, a fraction of an inch lower, and yet does not prevent the shaft from gradually moving upwards to any extent to supply the waste of the electrode, while B′ never follows the shaft higher than H.

The helix coil last described (fig. 28) may have its action on B′ augmented by making certain parts of the case in which the coil is wound, to be of soft iron in place of brass, as shown by the section of the case in fig. 29, the parts marked *a* being iron, and those *b* brass. The exterior circumference of the case is also cooped round with bits of iron fitting around the case, like the staves of a cask, bands of vulcanised caoutchouc being placed around them to keep them together. Or a cylinder of iron may be slipped over the end of the coil and envelope it. These pieces of iron augment the magnetic power of the other parts in several ways, and the main result is magnetic attraction between the lower end of B^1 and the ends of iron which project upwards from the lower end of the central hole in the helix case.

An electro-magnet may be used in place of the said helix coil surrounding the moving piece of iron; B^1, the poles of the electro magnet being presented obliquely or directly beneath B^1, and the form of B^1 being altered as to be the better suited to be attracted by both poles of the electro-magnet.

Reflectors may be adapted to electric-lighthouse lamps as well as to electric lamps of all sorts. I prefer the arrangement for this purpose shown in section by dotted lines in fig. 27. Portions of the reflectors are placed inside the glass bell or shade, and supported by projections from the tripod, and their continuation is effected by a separate piece properly placed around the shade, or they may be supported by wires branching from a ring which fits around the base of the glass shade. The form of these reflectors is described by the revolution of a hyperbola about its focal ordinate, which is coincident with the axis of the electrodes; the asymptotal plans of the hyperboloidal surfaces being at such an angle as will give a convenient amount of dispersion vertically to the horizontal sheet of light which they will produce, so that a slight variation in the height of the luminous focus will be of little moment, by reason of the extent of the vertical dispersion.

Twelfthly. My invention consists in improving in manner following the intensity of the electric current (whatever may be the nature of the lamp or apparatus used for producing the light): I effect this by including in the electric circuit a long coil of insulated copper ribbon wound in an iron case (such as shown in section at fig. 30 and part side view with cover removed at fig. 31), whereby I am enabled at the same

time to reduce the number of cells employed. The coil may be made in pieces separately wound on, and their ends joined in succession, the two extreme ends, A *e*, of the first and last coils being made to pass through the holes, *p*, *q*, in the case. A hollow cylinder of iron, or a number of bits of flat iron bar, *g*, *h*, are placed around the coil like the staves of a cask, and are held together by elastic bands of vulcanized caoutchouc. A good proportion for the substance of the coil is one-hundredth of a square inch of copper in section to every 40 yards of length. The ends of each coil are held from slipping back or unwinding, while the next coil is being wound, by being bent round and backwards over a pin, KK′, screwed into the side of the iron case. The numbers annexed to the arrows indicate the succession of the different portions of the coil on which they are placed. The letters A, B, C, D, E, indicate the commencement of each of the coils, and *a*, *b*, *c*, *d*, *e*, their several terminations.

Thirteenthly. My invention consists in inclosing the solid electrodes employed in electric lamps in supporting tubes, as represented in figs. 32, 33, and 34. When the electrodes are required to last for a long time, they have to be longer than is convenient for their strength or for the proper conduction of the electric current. I therefore use a tube, *e*, which serves to guard the electrodes, to hold them steady, and to conduct the electricity freely up to the top part of the electrode, the current being passed into the tube through the sole plate, c'', which is put in metallic connection with the negative wire. D″D″ (figs. 32, 33, and 34,) are spring conductors (they may be of iron) fixed on the tube, *e*, the tips of which embrace the electrode near the point where the light is developed. The electricity has by this means a free passage from the tube into the electrode. The tube may be fixed mechanically to the framework, *c*, c'', and yet insulated electrically from it, as shown in fig. 33, by means of collars of dry hard wood, *z z*, on the same principle as the legs of the upper electrode stand, K, are insulated from the sole plate, c''.

The electrode may be composed of many pieces slightly joined together, end to end, and placed in a tube, fig. 34, of any required length. To obviate the necessity of joining the parts firmly, the following arrangement, fig. 34, has been contrived, wherein the electrodes need never be drawn backwards in the tube; c'' is a piece of the supporting framework of the lamp made for the purpose of holding the tube steady, The tube has a free sliding motion for a short space, that is upwards, until the nut, *f*, touches the under side of z^3, and downwards until the collar, f^1, touches the upper side of z^3, or rather until it touches the part *q* which rests on z^3. The weight of the tube is nearly counterpoised by the elasticity of the spring, q', which is attached to an arm projecting from the tube, as shown, and has an arm, *q*, fixed to its other end, the further end, *q*, being forked so as to embrace the tube, and to rest the pressure of the spring upon the top of z^3. The weight of the tube being thus supported, it rises with the electrode, when it is pushed upwards by E^1, until *f* touches z^3, and after that the electrode rises by passing through the tube.

The parts of the fixed supports, *c* and c'', through which the tube passes may be insulated from the rest of the framework by collars of wood, as represented by z^2 and z^3.

Fourteenthly. My invention consists in the following improved modes of preparing the materials for electrodes: I take the powder of various carbonaceous matters, which make electrodes of different qualities as to illuminating power and resistance to abrasion by the electric current. The materials preferred are; first, plumbago powder, having its iron, &c., extracted by washing and warming in acids; second, lamp black; third, charcoal powder of sundry kinds of wood; fourth, the powder of the carbonaceous concrete which becomes deposited in gas retorts; or, fifth, grains of this latter substance sifted so as to obtain a somewhat uniform size of grain. Any one of these materials I mix with a quantity of brown sugar, in such proportions as are requisite to form a free paste with the powder when the mixture is melted by heat, a much larger proportion being sometimes employed for making the product cohere better. This mixture is melted and boiled (without water) until it becomes stiff; it is then pressed (while hot) into iron moulds of suitable shapes, the inside being lined with paper, or chalk, or plaster of Paris, to prevent the mixture from adhering to the mould, and to form a porous envelope through which the gases, &c., can slowly escape. The moulds have numerous small crevices or holes for the purpose of letting the gases and steam escape from the material when baked. The moulds when charged and closed tightly are heated very gradually, so as to allow sufficient time for drying and dispelling the gases without their destroying the compactness of the material. When a red heat is thus obtained, it is after a time allowed to subside, when the contents of the moulds are carefully taken out and placed upright in a crucible, which is filled with sand luted down and gradually raised to a white heat. At this high temperature they may be kept for some time, to give them greater mechani-

cal hardness and strength; they are then covered up and allowed to cool gently, and being cleaned if they retain a coating of any other substance, they are put into close fitting tin cases for use.

I preserve these electrodes from becoming damp, or otherwise injured, by coating them with tinfoil. In some cases also I prepare electrodes for use by wrapping them tightly in several thicknesses of metal foil, such as tin, for the purpose of giving them greater strength, and making them better conductors.

Good electrodes may sometimes be cut out of a lump of plumbago, either naturally or artificially compressed from the powder.

Before using the electrodes, it is sometimes beneficial to prevent the liability of their cracking when they become suddenly heated. This is done by fixing them in the lamp ready to light, and then passing the electricity through them without allowing the machinery to separate their extremities; this heats them gradually, and drives off any damp that may be in them.

Lastly; my invention consists in the employment of galvanic batteries for the purpose of obtaining various chemical products, and this, either in conjunction with the employment of them for lighting and motive purposes, or as substitutes for the ordinary processes of chemical manufacture. The batteries should be of one or other of the perfluent sorts before described, on account of the facilities which they afford for drawing off the products of the galvanic action, which products may consist either of matters in a marketable state, or which require some additional treatment to make them of commercial value. The elements proper to be employed will vary in each case with the chemical product or products desired to be obtained; or, to state the matter conversely, the perfluent products will vary with the elements employed. For example, where zinc is used as the positive metal with sulphuric acid, sulphate of zinc is formed. But sulphate of zinc in large quantities would not be of great commercial value. When, therefore, I use zinc as aforesaid, I collect the sulphate of zinc, and treat it as follows:—I add, in a separate vessel, to the solution of sulphate of zinc a solution of sesquicarbonate of ammonia, which precipitates the oxide of the zinc metal, and releases the acid, which may be used again. This oxide of zinc is a valuable substitute for carbonate of lead as a pigment, and may be used extensively for painting purposes. Again: suppose any of the salts of lead are required to be produced, such as nitrate of lead (white lead) or sulphate of lead, or any other chemical substance, to the production of which these salts may be auxiliary, the battery should be constructed of lead, or other metal plates platinized, and excited to action by dilute nitric acid. The acid acting on the oxide of lead formed by the electrolitic process, or decomposition of water, dissolves it, and forms with it, a solution of the nitrate of lead. And this solution is afterwards treated in a separate vessel or vessels, with the carbonate or bicarbonate of potash, when a double decomposition takes place, and the carbonate of lead being precipitated, the matter of commerce remains in solution, and is obtained by evaporation. Supposing further, the platinized plates (of lead or other metal) are used with muriatic acid (dilute or not), then the acid is decomposed, and a solution of chloride of lead is the resulting product. If for the platinized plates we substitute iron or zinc plates, the chloride of iron, or of zinc, is respectively obtained. Should a battery of copper and of iron plates, charged with a solution of sulphate of copper be employed, the iron is oxidized, the sulphuric acid unites with the oxide by superior affinity and forms with it, sulphate of iron (the green copperas of commerce), which remains in solution, and may be obtained by evaporation as before. The hydrogen which is released goes to the other pole, that is to the copper plate, and meeting there the disengaged oxide of copper, reduces it to the metallic state, and, in fact, plates the copper with it. This form of battery is directly applicable to the production of metallic copper from the ores of the sulphuret decomposed by water, or from the water drawn from certain copper mines which contain sulphate of copper in solution. The sulphate of iron obtained, forms also a very fine ochre.

Claims.—1. The combination of galvanic batteries so as to cause the perfluence of a single exciting liquid by means of channels.

2. The construction of galvanic batteries with flexible hose and funnels for the purpose of charging and discharging the cells.

3. The construction of the double fluid battery, before described, so as to cause the perfluence of two separate and distinct exciting liquids.

4. The equilibrated hydrostatic cistern for the purpose of supplying galvanic batteries.

5. The graduated meter to be attached to a cistern or supply vessel for the purpose of regulating or adjusting the quantity of exciting fluid, which may be intended to pass through the battery.

6. The mode of inclosing a liquid mercurial amalgam of zinc in a bag of lawn or horse-hair cloth, or other finely reticulated fabric for the purpose of being used in lieu of the amalgamated zinc plates or rods of galvanic batteries.

7. The amalgam of zinc and mercury in the proportions and for the purpose aforesaid.

8. The combination of lead (instead of zinc) as the positive element with any suitable negative element, and with nitric acid as the exciting fluid in galvanic batteries.

9. The improved galvanometer and graduated scale.

10. The several improvements in the formation of magnets.

11. The several improved modes of actuating the electrodes in electric lamps (represented in figs. 21 and 22).

12. The improved regulator for electric lamps (shown in figs. 21 and 22).

13. The revolving circular electrode with conical edges in combination with an edge scraper for electric lamps.

14. The mode of making the electrodes of electric lamps of iridium and alloys of iridium.

15. The employment in electric lamps of glass or other similar imperfect conductor of heat to envelope the metallic holder to which the electrode is attached.

16. The inclosing of the electrodes of electric lamps in supporting tubes and the making of them in pieces.

17. The insulation of the said electrode tubes from the metal stand, so as to allow of two or more separate lights being worked with separate currents of electricity independent of each other, (but never together) and under one glass shade.

18. The several arrangements for producing a regularly intermittent light from electricity suitable for lighthouses, and the various modifications by which the same may be adapted to the production of a permanent light.

19. The combination of an intensity coil (shown in figs. 30 and 31) with a galvanic battery.

And lastly. The employment in the formation of galvanic batteries for the purpose of obtaining chemical products, of the several combinations of galvanic elements and exciting fluids specified.

METHOD OF CUTTING THE TEETH OF THE DRIVERS OF PIN WHEELS OR TRUNDLES, BY MEANS OF SELF-ACTING MACHINERY. BY F. BASHFORTH, ESQ., OF ST. JOHN'S COLLEGE, CAMBRIDGE.

Fig. 4. Fig. 1.

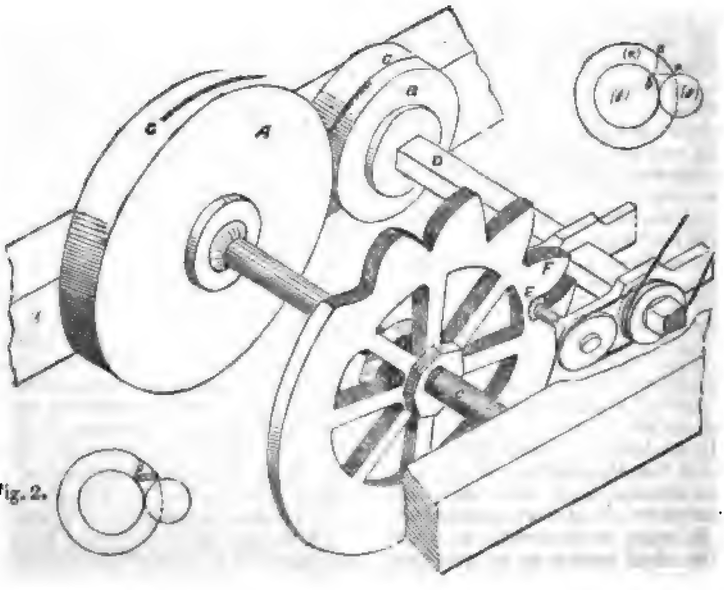
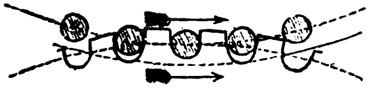


Fig. 2.

Fig. 3.



If (*e*) (*f*) be two concentric circles (fig. 1) connected together, and if another circle (*f'*) roll on (*f*) any point P, in the circumference of (*f'*), will trace the epicycloid P *bc* on (*e*), which is the form of tooth adapted to drive a trundle whose staves are supposed to be straight lines. We might have supposed the circles (*e*) (*f*) and (*f'*) to have been moveable, in one plane, about their fixed centres, without affecting the curve P*bc*, traced out by P on the circle (*e*).

If with P as a centre we describe a small *circle* (fig. 2), and suppose this to replace the *tracing point*, it will describe the form of tooth adapted to drive the trundle whose staves are of the same radius as the tracing circle. Fig. 3 shows how this property may be applied in the formation of the teeth of drivers of pin wheels.

C, D, are two parallel axles capable of revolving about two straight lines, their distance being $=R+r$: r, R, w, being respectively the radii of the pitch circles of the follower and driver.

A, B are two drums fixed respectively to the axles C, D.

E is a circular cutter which revolves about an axis parallel to that of D, and at a distance from it $=r$.

F is the wood model or cast-iron wheel to be cut.

Diameter of A : diameter of B :: R : r.

G, G, are chains used to secure the proper relative angular velocities of the drums A, B.

During the time of cutting an interval between two teeth, A, C and F are all rigidly connected together. The same may be said of B, D, and the cutter frame.

Provision must be made for releasing A, or F, from C, and for turning it through the known angle dependent on the number of teeth in wheel F.

Each stave of the trundle may be surrounded by a thin case-hardened cylinder left free to revolve, as in fig. 3.

If the breadth of the iron wheel were too great to be cut at one operation, the cutter E, might be mounted so as to admit of a slight motion on its axis, and a series of lines being cut, such as appear in the shading, fig. 4.

This kind of wheel was frequently recommended by Smeaton, and it is well known to produce a smooth motion when carefully formed. The self-acting machinery here suggested affords a ready means of securing any required degree of accuracy in the forms of the teeth, and the application of the division plate provides for the equality of the sizes of the teeth.

In all steam engines a slow motion of the piston is very desirable, but in locomotives and screw steamers a rapid rotation of the axis is absolutely necessary. A cast-iron wheel might be constructed in the manner here recommended, so as to fit into the place of one of the wheels with wooden teeth at present in use on board some of the screw steamers. The precision of form, thus easily to be attained, holds out a reasonable prospect of success. In the case of the *screw* being used as an auxiliary propelling power, it becomes highly desirable that the most advantageous application of the steam power should be made; for every ton of unnecessary weight of coal on board, at the commencement of a voyage, to that extent diminishes the disposable power of the vessel, besides adding to the expense of the propelling power.

The application of this method of increasing angular velocity is, in the first instance, recommended where no alteration of the neighbouring parts of the machinery would be required. If successful there, a great variety of other cases would present themselves.

S. Bashforth.

P.S. Fig. 4 shows form of teeth adapted to practical application. O is the pitch circle of the driver; M, the pitch circle of the follower.

VENTILATION OF SHIPS.

Sir,—In the last Part of your valuable Magazine there are some remarks by Dr. M'Sweeney on the ventilation of ships. The plan put forward by the learned gentleman is not wanting in ingenuity; but as it is deficient in so many respects as to be practically almost useless, it will not be found available for the purpose suggested by the inventor.

On Friday, the 12th instant, I had the honour to read a paper before the Royal Dublin Society, on "the general principles of ventilation," in which, amongst other matters, I mentioned that frightful catastrophe which seems to have brought out Dr. M'Sweeney's communication, and the account of which was one of the most

appalling recitals that it has ever been my lot to peruse. I can hardly agree with the doctor that his plan of getting rid of the foul air would have been sufficient in this case, though perhaps if the tube and valvular apparatus were of a considerable size, as the night was stormy and the pitching of the vessel very great, it might have answered, at least sufficiently to have saved the lives of the ill-fated passengers. But the objections to the general use of this mode of ventilating ships are so obvious, that I wonder the learned doctor was not struck by them; and, with your leave, I would mention the principal of them, to prevent any one being deceived by a plan which, at first sight, might appear somewhat feasible to those who had not studied the subject of ventilation.

In the first place, it is not sufficient (especially in ships) to trust to the chinks and openings for the supply of fresh air, as it is just as necessary to provide a passage for the entrance of pure air, as it is to construct an exit for the vitiated atmosphere. Secondly; the doctor's air-pump is inapplicable in calm weather, or when the ship is stationary, either in harbour or when becalmed, at which time ventilation may be much required—for instance, in a tropical climate. Thirdly; a steamer may be moving rapidly without any *rolling motion*, which is essential to the working of the doctor's plan; therefore the abstraction of foul air and the supply of fresh, would not be sufficiently rapid for the health and comfort of the passengers on a calm day, even in this latitude. Indeed, wind sails, though also very objectionable, are preferable to this air pump, as there is less uncertainty in their action. Fourthly; it strikes me that this appendage would be very unsightly, and not a little in the way during the loading or discharging of the ship. The only advantage I can see in this invention is, that (when it works at all) it is self-acting; but, as I have before stated, it will not perform its duty when it is most required.

The proper mode of ventilating a ship is by means of a revolving fan, which, in a steamer, may be worked by the engine, when the vessel is in motion, or in any ship by a suitable mechanical contrivance, such as a spring or weight. A small compartment, containing this fan, should be connected by tubes with the apartments of the ship, which tubes should terminate or open at the upper part of the room. There should also be other tubes for the conveyance of the pure atmosphere outside, which should open, if possible, through the floors of the different cabins. The object of this arrangement is, that the impure atmosphere may escape from that part of the room at which it accumulates, it being an axiom that the *current of air* in an apartment, from whatever cause it may be heated, either by artificial modes of warming or lighting, or by the act of respiration, *invariably tends upwards*. The *pure* atmosphere should always be allowed to *enter* a room *below*, the *impure* to escape *above*, and this is equally the case whether we wish to ventilate houses or ships.

I trust these remarks on a most important subject from one who has given some attention to the subject, will not prove uninteresting. The study of ventilation is not so simple as at first sight it might appear; for almost every apartment, from peculiarity in its structure or position, will require some deviation from any general plan which may be laid down.

I am, Sir, yours, &c.,

CHAS. E. BAGOT, M.D., M.R.D.S.

12, Charlemont-place, Dublin, January 20, 1849.

ON THE APPLICATION OF INDETERMINATE COEFFICIENTS TO SERIES WITH ALTERNATE SIGNS. BY PROFESSOR YOUNG, OF BELFAST.

I do not observe, in books of algebra, any directions for the summation of series, with signs alternately plus and minus, by the method of Indeterminate Coefficients; and I think it likely that it would be agreeable to young algebraists to have the mode of proceeding in such cases exhibited to them. Perhaps an example, worked at length, will sufficiently illustrate the process to be applied; and this is the plan I shall adopt in the present brief communication; presuming that the method of operation, in the case of series with all the signs plus, to be previously known. The example I shall take is the following; namely:—

$$S = 1\cdot 4 - 3\cdot 6 + 5\cdot 8 - 7\cdot 10 + \&c., \text{ to } n \text{ terms.}$$

Let $S' = 1\cdot 4 + 5\cdot 8 + 9\cdot 12 + \ldots\ldots (4n-3)\,4n = An^3 + Bn^2 + Cn$;

then, adding an additional term to the series, and as a consequence, changing n in the right-hand expression into $n+1$, and subtracting; or, which is the same thing, developing each term of that expression, after this change, suppressing in each case the leading term of the result, we shall have

$$(4n+1)(4n+4) = 16n^2 + 20n + 4 = 3An^2 + 3An + A$$
$$+ 2Bn + B$$
$$+ C$$

$$\left.\begin{aligned} \therefore 3A = 16 \;\therefore A &= \frac{16}{3} \\ 3A + 2B = 20 \;\therefore B &= 2 \\ A + B + C = 4 \;\therefore C &= -\frac{10}{3} \end{aligned}\right\} \therefore S' = \frac{16}{3}n^3 + 2n^2 - \frac{10}{3}n.$$

Again: let $S'' = 3\cdot 6 + 7\cdot 10 + 11\cdot 14 + \ldots\ldots (4n-1)(4n-2)$; then, proceeding as before,

$$(4n+3)(4n+6) = 16n^2 + 36n + 18 = 3An^2 + 3An + A$$
$$+ 2Bn + B$$
$$+ C$$

$$\left.\begin{aligned} \therefore 3A = 16 \;\therefore A &= \frac{16}{3} \\ 3A + 2B = 36 \;\therefore B &= 10 \\ A + B + C = 18 \;\therefore C &= \frac{8}{3} \end{aligned}\right\} \therefore S'' = \frac{16}{3}n^3 + 10n^2 + \frac{8}{3}n$$

$$\therefore S' - S'' = \qquad -8n^2 - 6n$$

Hence, when n in the proposed series is even, the sum is what this expression becomes when $\frac{n}{2}$ is put for n, viz.,

$$S = -(2n^2 + 3n) = -n(2n+3)$$

To find the sum when n is odd, we must put $\frac{n+1}{2}$ for n in S', and $\frac{n-1}{2}$ for n in S''; so that we shall then have

$$\begin{aligned} S' &= \frac{16}{3}\left(\frac{n+1}{2}\right)^3 + 2\left(\frac{n+1}{2}\right)^2 - \frac{10}{3}\left(\frac{n+1}{2}\right) \\ &= \frac{2}{3}(n+1)^3 + \frac{1}{2}(n+1)^2 - \frac{5}{3}(n+1) \\ S'' &= \frac{2}{3}(n-1)^3 + \frac{5}{2}(n-1)^2 + \frac{4}{3}(n-1) \end{aligned}$$

$$\therefore S' - S'' = 4n^2 + \frac{4}{3} - 2n^2 + 6n - 2 - 3n - \frac{1}{3}$$

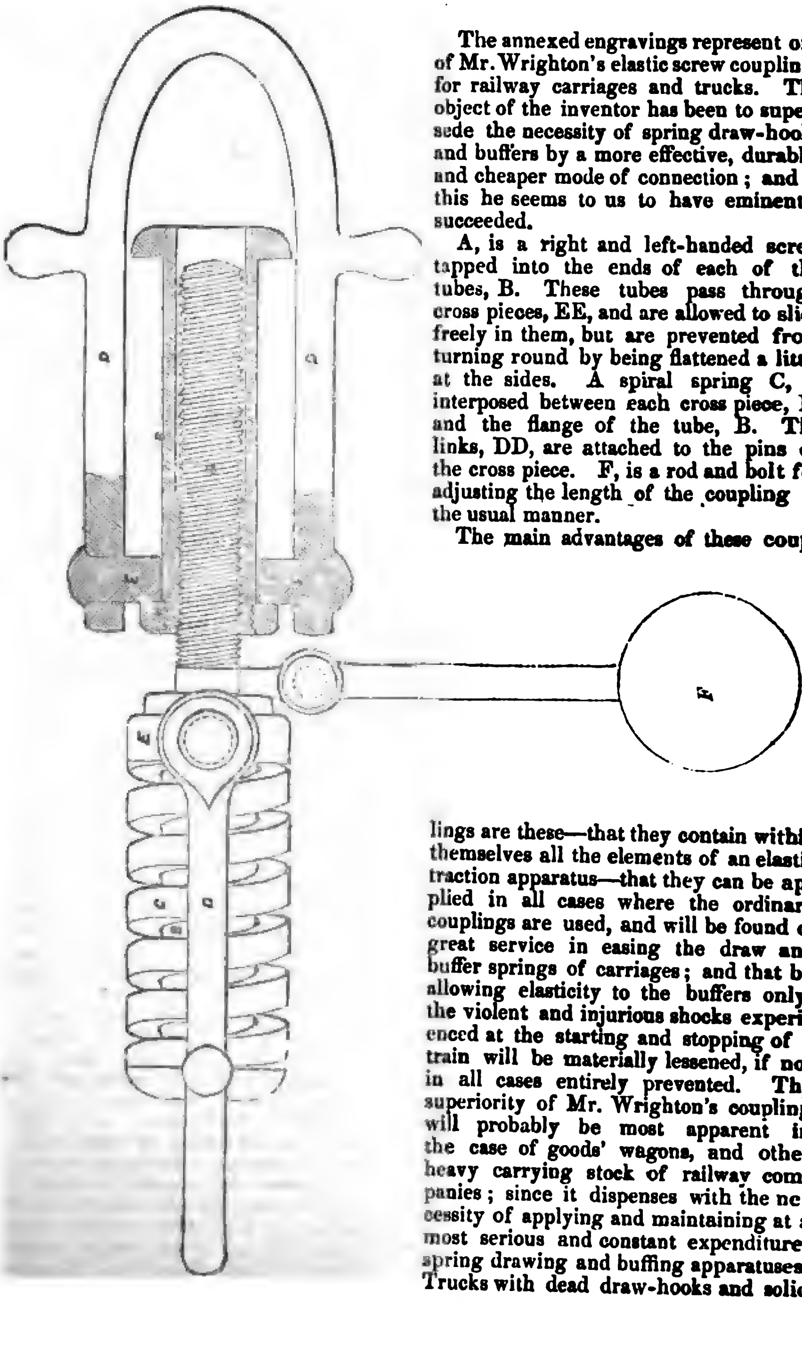
that is

$$S = 2n^2 + 3n - 1 = n(2n+3) - 1.$$

And this is the method of proceeding in every similar case. It may be remarked too, that n terms of any other series, not summable by the method of indeterminate coefficients, may, when the terms are alternately plus and minus, be split into two series, as above, and treated in an analogous manner, the preceding substitutions for n being made in the sums and the difference of the sums of the component series.

Belfast, January 17, 1849.

WRIGHTON'S PATENT COUPLING.



The annexed engravings represent one of Mr. Wrighton's elastic screw couplings for railway carriages and trucks. The object of the inventor has been to supersede the necessity of spring draw-hooks and buffers by a more effective, durable, and cheaper mode of connection; and in this he seems to us to have eminently succeeded.

A, is a right and left-handed screw tapped into the ends of each of the tubes, B. These tubes pass through cross pieces, EE, and are allowed to slide freely in them, but are prevented from turning round by being flattened a little at the sides. A spiral spring C, is interposed between each cross piece, E, and the flange of the tube, B. The links, DD, are attached to the pins on the cross piece. F, is a rod and bolt for adjusting the length of the coupling in the usual manner.

The main advantages of these couplings are these—that they contain within themselves all the elements of an elastic traction apparatus—that they can be applied in all cases where the ordinary couplings are used, and will be found of great service in easing the draw and buffer springs of carriages; and that by allowing elasticity to the buffers only, the violent and injurious shocks experienced at the starting and stopping of a train will be materially lessened, if not in all cases entirely prevented. The superiority of Mr. Wrighton's coupling will probably be most apparent in the case of goods' wagons, and other heavy carrying stock of railway companies; since it dispenses with the necessity of applying and maintaining at a most serious and constant expenditure, spring drawing and buffing apparatuses. Trucks with dead draw-hooks and solid

buffers will, by this means, be as effectually protected from injurious concussions as if provided with spring buffers and draw-hooks; all that is required is to make the dead buffers sufficiently long to admit of the coupling being slightly tightened when the buffers touch. Again; by adopting the long dead buffers recommended, the frightful accidents that are constantly occurring at railway stations from porters and other servants of the Company getting crushed between the trucks, in coupling or uncoupling, will be altogether prevented.

Some experiments with this coupling have been tried on the Eastern Union Railway, for the purpose of testing its efficiency. Two trucks, with dead draw-hooks and solid buffers, were connected by one of the couplings and attached to one of Slaughter and Co.'s 15 inch cylinder luggage engines, and as many loaded trucks as the engine could draw were placed behind them. The train was then drawn and shunted about the different lines at the Ipswich station, but in no case could the slightest blow or shock be felt between the two trucks so connected, although the engine was frequently started and stopped very suddenly.

The action of the coupling at first starting is to give out its elasticity, and it continues to do so while the train is in motion—adjusting itself to the resistance it has to overcome, either upon a straight or curved road. The buffers open for a little distance—varying from one to three inches, according to the gradients, weight of the train, inequalities in the road, &c.; but immediately the steam is shut off, they come gently together without any perceptible shock or concussion.

CURIOUS EXPERIMENTS IN ORGANIC REPRODUCTION.

In the *Dublin University Magazine* for February, 1846, there is an extract from a work of Oetinger, entitled "Thoughts on the two faculties of Feeling and Knowing," in which the following singular experiment is related:

"I chopped up some balm, put it into a large glass retort, poured rain-water upon it, connected the retort with a good-sized receiver, and let it heat at a cuppel—gently at first till the water went over, then more strongly. Upon this there went into the water a yellow-greenish oil; it took up the whole space of the receiver and swam on the surface of the water, the thickness of the back of a table-knife. This oil had the form of innumerable balm-leaves; which did not lap over or run into one another, but lay side by side, each perfectly drawn, and with the distinct indication of all the lines of a balm-leaf. I let it stand a long time, that all about me might observe it. At last I shook the receiver because I had to pour it out; the leaves ran together, but in less than a minute restored themselves to their former position, *distinctissime*."

A few days after reading the above, I came quite unexpectedly upon a similar account in a place where one would certainly not imagine anything of the sort likely to be found—viz., in Pitaval's "Causes Celebres"—a collection of the most celebrated criminal trials in the French courts, (the source whence Dumas has drawn the greater part of his popular work "Celebrated Crimes"). In the 12th volume there is one entitled. "Le Spectre, ou l'illusion reconnue;" at the end of which Pitaval enters into some reasoning on the subject of spectral illusions, and very strangely brings forward the following experiments to show that the forms of things may exist without their subject-matter (the experiment of Oetinger, just quoted, was related with exactly the same object).

"D'ailleurs, il est possible que l'apparition des spectres ait une cause naturelle par une autre raison. Les Chimistes montrent que la Palingénésie, ou la resurrection des plantes est fort possible. D'habiles Chimistes, en fort grand nombre, ont fait des expériences, par lesquelles, en mettant les cendres d'une plante dans une phiole, ces cendres s'exhalent, et s'arrangent autant qu'elles peuvent, selon la figure que leur a d'abord imprimé l'auteur de la nature. L'Abbé de Vallemont, dans un Traité qu'il a fait de la curiosité de la Nature et de l'art, enseigne le secret pour faire cette Palingénésie. Il dit que le pére Schot Jesuite, a assuré que dans le temps qu'il étoit à Rome il eut la satisfaction de voir cette rose qu'on faisoit sortir de ses cendres, toutes les fois qu'on le vouloit avec un peu de chaleur. Le même auteur, que nous avons cité, enseigne le secret d'une eau minérale, qui fait reverdir une plante morte qui a sa racine, et qui la met en même état que si elle poussoit en pleine terre. De cette Palingénésie des plantes, on est venu à la Palingénésie des animaux.

M. Digby, d'animaux morts, pilés et broyés, en a tiré de vivants de la même espèce (?) Mais rapportons ce que dit Gaffarel, un très-habile chimiste. M. Duchêne, dit-il, un des meilleurs chimistes de notre siecle rapporte qu'il a vu un très-habile Polonois, medecin de Cracovie, qui conservoit dans des phioles la cendre de presque toutes les plantes: de façon que, lorsque quelq'un, par curiosité, vouloit voir par example une rose dans ces phioles, il prenoit celle dans laquelle la cendre du rosier etoit gardée, et la mettant sur une chandelle allumée, dès qu'elle avoit un peu senti la chaleur, on voyoit remuer la cendre, qui s'elevoit comme un petit nuage obscur, qui, après quelque mouvement, venoit enfin à representer une rose si belle, si fraîche, et si parfaite, qu'on l'eut jugée être palpable et odorante comme celle qui vient du rosier. Ce savant homme dit qu'il avoit souvent tâché de faire la même chose, et que n'ayant peu en venir à bout, le hazard lui avoit fait voir à-peu-près le même prodige. Comme il s'amusoit avec M. de Luynes de Formentieres, Conseiller du Parlement, à voir la curiosité de plusieurs expériences, ayant tiré le sel de certaines orties brûlées, et mit la lessive au serein d'hiver, le matin il la trouva gelée; mais avec cette merveille, que les espèces des orties, leur forme et leur figure, étoient si naïvement et si parfaitement representées sur la glace, que les vivantes ne l'étoient pas mieux. M. Duchêne, étant comme ravi, appella M. de Luynes, pour être tèmoin d'un spectacle si curieux; et à la vue de ce prodige, il conclut en ces termes :—

'Ce secret nous apprend, qu' encore que le corps meure,
Les formes font pourtant aux cendres leur demeure.'

'A présent,' ajoute Gaffarel, 'ce secret n'est plus si rare; car M. de Claves, un des excellens chimistes de notre temps, le fait voir tous les jours. D'ou l'on peut tirer cette conséquence que les ombres des trépassés, qu'on voit souvent paroître aux cimetières, sont naturelles, étant la forme des corps enterrés en ces lieux, ou la figure exterieure; non pas l'âme, ni des fantômes bâtis pas les démons, ni des génies, comme quelqu'uns l'ont cités. Il est certain que ces apparations peuvent être fréquentes aux lieux où il s'est donné des batailles; et ces ombres ne sont que les figures des corps morts, que la chaleur ou un petit vent doux excitent, et élevent dans l'air. C'est une belle question,' continue Gaffarel, 'savoir si ces formes admirables, sorties des cendres des corps, peuvent servir d'argument infaillible de la resurrection ignorée de plusieurs philosophes.'"

A. H.

THE PLANET NEPTUNE AND ITS DISCOVERY.

[We make the following select extracts from a lecture on the above subject delivered at the Exeter Athenæum, 24th November, 1848, by James Jerwood, Esq., M.A., F.C.P.S., F.G.S., &c., and just published, by Messrs. Longman and Co. Mr. Jerwood's narrative of "the discovery" is the best, the truest, and the most generally intelligible we have ever yet read; but he who would duly appreciate the masterly style, the nicety of discrimination, and the strict impartiality of the author, and the generous, yet every way justifiable warmth with which he has advocated the claims of his old brother collegian, Mr. Adams, must have recourse to the lecture itself. Mr. Jerwood promises to "follow up the matter more fully" hereafter; but we really do not see that he has left anything to be said or sung. He has placed Mr. Adams on the pinnacle of fame—what can he do more?]

So early as July the 3rd, 1841, Mr. J. C. Adams, then an undergraduate of St. John's College, Cambridge, wrote in his diary the following memorandum. "*Formed a design in the beginning of this week, of investigating, as soon as possible after taking my degree, the irregularities in the motion of Uranus, which are yet unaccounted for, in order to find whether they may be attributed to the action of an undiscovered planet beyond it, and, if possible, thence to determine approximately the elements of its orbit, which would probably lead to its discovery.*"

* * * *

The first rough solution that he arrived at, in 1843, afforded him a που στω—the calculations, though rough, were sufficiently exact to satisfy him that his hypothetical explanation of the anomalies of Uranus was correct. In 1844, having obtained from the Astronomer Royal the observations made at Greenwich, Mr. Adams renewed his investigations, and the solution was more complete than before; in this way, several solutions were obtained, differing little from each other, only taking into account more and more terms of the series of perturbations—first in April, 1845—again in May, and finally in September, in that year, when an accurate solution of this untried problem was communicated to Professor Challis, of the Cambridge Observatory, and in the fol-

lowing month to the Astronomer Royal. In that month, namely, Oct., 1845, Mr. Adams personally left the astonishing results of his investigations at the Royal Observatory for the Astronomer Royal. The elements of the orbit of the exterior planet, which he then and there left, were found to account for all the principal irregularities of Uranus to a surprising degree of exactness.

Such was the course followed by Mr. Adams, until he had accomplished his brilliant feat. In October, 1845, when Mr. Adams delivered his papers at the Royal Observatory, there is not a particle of evidence extant to prove that any human being had even roughly attempted the Herculean task. Mr. Adams alone, in 1845, had given a complete solution of the inverse problem of perturbations, which enabled him unfalteringly to say to the astronomers—"Look at a given point in the immensity of space, at a given time, and you will find a planet never yet seen, which has occasioned all the irregularities of Uranus!" Well might the Astronomer Royal assert that, "in the whole history of science, there is nothing like this!"*

It is quite clear that, in October, 1845, Mr. Adams had done all that a mathematician could do: he had determined the elements of the orbit of the exterior planet, and had put them into the hands of Professor Challis and the Astronomer Royal, two of the most celebrated astronomers in existence, and having two observatories under their guidance, which are perhaps unequalled by any in Europe. Had those gifted astronomers searched the heavens in the spot pointed out, they must have found the planet—and the grand, the novel, the astonishing discovery, and all its honour, would have been altogether English; for at that time there was not even a pretender in the field. Unfortunately, however, Mr. Adams's splendid achievement was permitted to remain in the Astronomer Royal's keeping unnoticed, or at least untested.

Neither of the English astronomers made any use of the appliances at their command to search the spot, and at once to try the accuracy of Mr. Adams's astonishing results. Time passed along. *Eight months* were suffered to elapse, and Mr. Adams's investigations still untested, when a memoir on the same subject was published in the *Comptes Rendus*, by Leverrier, a very celebrated French astronomer, giving ONE element of the exterior planet's orbit, very nearly agreeing with *one* of the FIVE elements which Mr. Adams had put into the Astronomer Royal's keeping *eight months* before! Three months after this, Leverrier published the remaining elements—almost exactly coinciding with those which Mr. Adams had put into the English astronomers' possession nearly a year before. Mr. Adams, on the completion of his investigations, put the results into the hands of practical astronomers, where they were unaccountably suffered to remain untested. Le Verrier followed exactly the same course. He at once sent the elements of the planet's orbit to M. Galle, a distinguished practical astronomer of Berlin, who, the same evening that he received them, found the planet occupying the position which Mr. Adams had determined and predicted a year before!

There is no time now to contrast the instant activity of the German astronomer with the unfortunate indifference of the English astronomers: nor will I dwell on the exceedingly disheartening topic of comparing the reception which Mr. Adams's labours met with in England, with that which Le Verrier's received at Berlin.

However, with regard to the rival claims of Mr. Adams and Le Verrier, as to priority of discovery, it may be remarked, that shortly after Leverrier appeared in the field, there was, or I thought there was, an evident intention in certain writers to throw dust in the eyes of the British public—to mystify the matter, and to honour the French astronomer at the expense of Mr. Adams. The question has raised much controversy.* But, notwithstanding the discussion which the discovery has occasioned, and the number of articles which have been written upon it, the topic is far from being exhausted. I consider the subject to be quite an English one, and I intend hereafter to examine all the evidentiary facts which admit of no doubt, with the view of following up the matter more fully than I fancy it has hitherto been done. Common justice demands that the claims of our highly gifted countryman, whatever they may be, should be placed on the basis which they justly ought to rest upon. I believe I have read everything of note that has been written

* Proceedings of the Royal Astronomical Society for November 13th, 1846.

* See the *Mechanics' Magazine* for Dec. 1846. The *Athenæum* for 1846, 1847, and 1848. The Memoirs of the Astronomical Society. The *Phil. Mag.* for the years mentioned. The *North British Review*, already referred to. The Planet Neptune, by Dr. Nicholl. Lawson's Short History of Neptune. Professor Young's Paper in the *Northern Whig*, for March 7, 1847. The *United Service Mag.*, Nos. 122, 123. The *Literary Gazette*. The *Civil Engineer's and Architect's Journal*, each for the years named. The Papers published by the Syndicate appointed to visit the Cambridge Observatory. The Rev. Richard Sheepshank's Pamphlet, entitled—"Reply to Mr. Babbage."

upon the subject. I have attentively looked into Le Verrier's Memoirs, and I am quite willing to pay homage to his great genius. His solution of the problem occupies upwards of two hundred octavo pages, and the bare perusal of it is a task that makes one dizzy.* But Mr. Adams's investigations† are equally profound, every line of which requires analytic skill of the highest order. The whole performance, be it remembered, was completed and in the hands of the Astronomer Royal eight months before any human being had entered upon the subject. Let it be borne in mind that the mere seeing of the planet by Galle forms no part whatever of the discovery. The finding of the trans-Uranian planet depends entirely upon the solution of the inverse problem of perturbations which fixed its position and pointed out the spot where it was, and we have evidence that admits of no cavil or doubt, that Mr. Adams had alone and unassisted fully solved the problem, and put the results of his investigations, clearly pointing out the position of the unseen planet, exactly where it was found, into the English astronomer's hands, at least *eight months* before any known person had commenced the subject or given it a thought; there can therefore be no rational doubt about Mr. Adams's claims to priority in this extraordinary discovery. Grudge the honour who may; deny the merits who dare; the sole and undisputed honour of it is an Englishman's; and it would be a disgrace to the nation if it were to allow that honour to be filched from Adams, or in any way smuggled over to another.

The celestial stranger has nobly acted its part,‡ for whilst stories have propagated that Neptune is no planet, or that it is another—Neptune during the past summer has kept itself favourably situated for observing, and it has been observed during every clear night at the Cambridge Observatory—moving in the orbit which Mr. Adams determined so many months before any one else had given the subject a thought. Let envious cavillers say what they like — the planet verifies all Mr. Adams' predictions, confirms the truth of his astonishing investigations, and confers on him the undivided, the unique, the splendid honour of having found the place of a planet thousands of millions of miles off, by the almost superhuman efforts of pure intellect; again, in the enthusiastic words of the Astronomer Royal, it may be said, "In the whole history of science, there is nothing like this."

When we reflect that the dimensions of Jupiter had not been accurately determined ten years ago, it will hardly be expected that the dimensions of Neptune are yet exactly known, and consequently that the time of its revolution is finally determined. At present its diameter is supposed to be 26,800 miles, or about 3 three-ten times the diameter of the earth—that it performs a revolution in 167 sidereal years, and that its mean distance from the sun is 2,890,000,000 miles, much less than Bode's law would make it; but even at this distance a cannon ball flying at the average rate of 480 miles per hour, would occupy 686 years in flying from the sun to Neptune. Light flies at the rate of about 193,000 miles in a second of time: at this rate, light would be 4h. 9m. 46s. in flying from the sun to Neptune. We can express immense distances and great velocities in figures and properly enumerate those figures, but I much doubt whether any of us have anything like a just notion of these distances and velocities: and for this reason, we have no standard rule at hand with which to compare them. Did you ever attempt to form an idea of the velocity with which light travels? You may, perhaps, form a rough one in this way; the earth is about 25,000 miles in circumference: light, at its usual rate, would fly round the earth nearly *eight times* in the beat of a clock; or whilst you can flip your finger! It would fly round three or four times whilst the quickest person could prepare to flip: "The poets' eye, in a fine phrensy rolling, doth glance from heaven to earth, from earth to heaven," so it may, but it forms, nor gives, no estimate of the distance between them. "Quick as thought," is proverbial,* but try to make thought follow light round the earth at the above rate, and you will soon perceive that thought, comparatively speaking, travels at a snail's

* Le Verrier's Solution is published in the "Additions à la Connaissance des Temps," 1849. See also "Comptes Rendus des Seances de l'Academie des Sciences," tome xxi., p. 1051; t. xxii., p. 907; t. xxiii., p. 428; t. xxiii., p. 607.

† Mr. Adam's Investigations are published as an Appendix to the *Nautical Almanack* for 1851; his solution has also been published in a work entitled "An Explanation of the observed Irregularities in the Motion of Uranus." There is no kind of diagram employed either by Mr. Adams or M. Leverrier—their solutions are purely analytical.

‡ The planets place for Gr. mean midnight, on the 20th of September, 1848, was,

R.A. 22h. 11m. 9s. 94 }
N.P.D. 101 56 3 3 }

* Mr. Hunt, in his interesting book, "The Poetry of Science," speaking of the sun, says, "From 'that fountain of light' we find this principle travelling to us at a speed which *almost approaches the quickness of thought itself.*" This would seem to controvert what is said above. Mr. Hunt is very high authority upon such matters. I can only say that I cannot make my thought *keep up* with light, supposing it to fly round the earth at the rate mentioned.

pace; the attempt, however, may, to some extent, give you some notion of the amazing distance of Neptune. But to return.

The discovery of the new planet, Neptune, by a purely intellectual process, is one of the grand feats of the age in which we live. It is an index, showing the eminence to which mathematical science has forced itself. At present, it indicates the highest point in the progress of human intellect, as far as abstract science is concerned. Wherever astronomy is cultivated, this singular discovery will be contemplated with admiration. Wherever science is properly appreciated, no matter in what clime or country, there will the mighty intellect, which alone and unassisted has accomplished so vast an undertaking, be held in reverence, and be the subject of wonder and admiration!

But who was, and what is, Mr. Adams, whose genius has shed such a brilliancy over his country? Who in his solitary chamber, by the innate force of his intellect, has, as it were, called bodies into being, to which imagination had hardly dared to give existence?

If you have ever travelled between Launceston and Camelford, in Cornwall — just inside Devonshire—you have passed over a moory district, almost as bleak as our own Dartmoor, and apparently much more barren. If your journey was performed on the outside of a coach, when the sleet was driven into you by a biting north-easter, you will require no refresher to put you in mind of that unhopeful tract. But there, in that region of moorland, resided an industrious farmer, the father of Mr. Adams, and this moory land, though it would grow little or nothing besides, has grown Mr. Adams, one of Nature's highest nobles. It would be difficult to imagine a spot more unlikely to nurture genius, more ungenial to its growth, or even to its existence; yet there, in that remote and chilling district, did Mr. Adams teach himself, and lay the foundation for that celebrity which he now so justly enjoys. I believe the only assistance in his studies that he obtained before he went to Cambridge was given to him, for a short time, by the Rev. Mr. Martin, the indefatigable and respected master of our training school, who then resided in that neighbourhood. Whilst a very young man, Mr. Adams was entered at St. John's College, Cambridge, the distinguished nursery of Senior Wranglers; there he had many advantages: at the end of his Undergraduateship he became Senior Wrangler and first Smith's Prize-man, two of the *highest* honours which any one can gain at that University.

At Cambridge, there are upwards of a hundred students every year who try for honours. A large number of young men go there possessed of every advantage. They have been purposely well taught, and they have all that tutors can do for them during the three or four years they are there. They are urged on by rewards of merit, and by hopes of distinction. There are many to whom a high degree is a fortune—to all it is valuable, because throughout life it may be referred to as a mark of intellectual eminence. With such a number of competitors, therefore, the trial for honours is a kind of mental steeple chase, and if, *in coming in*, the ardent rivals do not break their necks, many of them so injure themselves, by their intense exertions, that they never recover their health. In 1843, when there were about 120 anxious candidates for distinction, the farmer's son from the moory district, an unpretending retiring young man—I suppose not more than 21 or 22 years of age—beat them all to nothing!

Having triumphantly carried off the highest honours which one of the chief Universities in the world had to bestow, Mr. Adams, as I have already mentioned, set to work about the resolution which he had previously formed, respecting the perturbations of Uranus; and by accomplishing the task which he prescribed for himself whilst an Undergraduate, he has placed himself in the very first rank of living astronomers. He has gained for himself the admiration, as well as the astonishment of the principal mathematicians in Europe.

It has been already named, that Mr. Adams has met with some strange neglect; but he has also been paid many flattering marks of distinction. Besides having been made a Fellow and assistant-tutor of his college, the Master and Fellows of St. John's have nobly subscribed a large sum of money,* and with it they have founded a prize, to be called "THE ADAMS' PRIZE," in honour of his having discovered the planet Neptune — this will hand down his name to posterity as long as the University shall last. Her most gracious Majesty, the Queen, when at Cambridge, expressly ordered Mr. Adams to be introduced to her, and she would have conferred an honour upon him, but he, I think unwisely, declined to accept it. The Government have at their disposal a very moderate sum to bestow as pensions on literary and scientific men of merit—much to their credit, they have given Mr. Adams one, as a national recognition of his extraordinary achievement.

I trust that higher honours, and other distinctions, are in store for him—he deserves them; for, besides his own intrinsic merits,

* Amounting to upwards of 1,300*l*.

he is a splendid example to prove that men may raise themselves from the lowest and obscurest situations to the highest honours.

There is scarcely one amongst you who has not greater advantages than Mr. Adams once had, and who is not better situated for moving up than he once was. His splendid career is, therefore, most valuable to you, and me, and every one who has to make his way through life as well as he can; for it proves what merit alone can do. And here I must in justice add—for Mr. Adams fully proves its truth—that, with all its drawbacks, it is a glorious feature in our dear old country, that, provided a man have talent, untiring industry, and unimpeachable honesty, no matter how obscure his origin, or humble his parentage, the road to distinction is open to him; and there is scarcely an honour, however high, or a position, however proud, that he may not ultimately gain. To such a man, our country invitingly, as well as truthfully, says—

"*Honour* and *shame* from *no condition* rise—
Act *well* YOUR *part*—THERE ALL the HONOUR lies."

STEAM-BOAT RACE.—DEAD HEAT.

On Friday, the 19th instant, an experimental trip was made from Blackwall to Gravesend and back with the steam-boat *Emmet*, which is a doubled-bowed or Janus-shaped iron boat, and intended to ply as a halfpenny passenger-boat above bridge. She is fitted with a very beautiful pair of oscillating engines, made by Messrs. Joyce and Co., of the Greenwich Iron Works. Each engine is nominally of 20 horses power, but gives off, in reality, according to Watt's standard, nearly four times that amount of power. They work with admirable exactness, and, both in design and workmanship, are not surpassed by any on the river.

The framing is particularly deserving of attention for a happy combination of lightness and strength. It is made entirely of wrought iron, which, is much more expensive than cast iron, but occupies a much less space.

On the day of the experimental trip, the *Emmet* left Blackwall, with tide, at 10 minutes to 1 o'clock, and arrived off the Town Pier, Gravesend, at 2 precisely, having accomplished the distance in one hour and ten minutes, and attained the speed of upwards of 17 miles an hour. On the return, she waited off Erith for that well-known crack vessel, the *Brunswick*, which runs between Blackwall and Gravesend, and ran with her neck and neck (or rather nose and nose) the whole of the rest of the distance to Blackwall. It was a most exciting race. For at least six miles of the run the paddle-boxes were within a foot of each other, and neither boat could gain the least advantage over the other. Both vessels reached Blackwall at the same instant.

The fact well deserves recording, that a little halfpenny steamer should have fairly held her own, against one of the most powerful and fastest of the eighteen-penny liners.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED BETWEEN FRIDAY, JAN. 20, AND FRIDAY, JAN. 26.

WILLIAM SWAIN, Penbridge, brickmaker. *For certain improvements in kilns for burning bricks, tiles, and other earthen substances.* Patent dated July 18, 1848.

The kiln described by the patentee may contain any number of furnaces, the arrangements for each being the same. In the side of the kiln is the feed passage (closed by a door fitting tightly) which slants downwards, and has a projecting brick at bottom, to throw off the coals into the furnace. The furnace is built of fire-bricks, with spaces between them, and is fitted with furnace bars and ash-pit in the ordinary manner. The passage for the admission of air to the fuel is closed by a door, which fits tightly, and is furnished with another small door in the centre, just large enough to admit a rake. All the passages are closed by doors made to fit tightly, and in the form of a plate, which turns on a pivot, slides over the aperture, and is supported against a projecting stop.

Claim.—The patentee does not claim any of the details above given, so long as the peculiar character of his invention is retained, whereby a greater influx of air than is necessary for combustion to the interior of the kiln is prevented.

[The "peculiar character"—what is that? It is a great mistake in patent specifiers to suppose that they can by a mere form of words, get rid of the plain obligation on all inventors, to point out in clear and distinct terms, in what respects their inventions differ from others.]

CHARLES PURNELL, Liverpool, clockmaker. *For certain improved apparatus to be applied to timber-loaded and other vessels laden with materials, the specific gravity of which is lighter than water, preventing the necessity of abandoning them at sea, by ridding them of the superincumbent water, and enabling them thereby to carry sail.* Patent dated July 18, 1848.

These apparatuses consist of cisterns of the capacity of from 50 to 100 gallons of water, according to the tonnage of the vessel, which are fitted to the fore and aft of the vessel inside. The cisterns are open at

top and closed at bottom by a self-acting valve (which communicates with the sea by a pipe), or by a plug connected to a weighted lever, so as to open to pressure from the inside, and close to pressure from the outside. When the vessel rolls to starboard, the cisterns on that side will fill; and on her rolling to larboard, the cisterns will be opened either by the pressure of the water against the valves or by the withdrawal of the plugs by the action of the weighted lever, and the water contained therein allowed to flow out.

Claim.—The improved apparatuses, or any modification of them, applied to timber-loaded and other vessels laden with materials the specific gravity of which is lighter than water, preventing the necessity of abandoning them at sea, by ridding them of superincumbent water, and enabling them thereby to carry sail.

JOHAN ARNOLD STEINKAMP, Leicester-square, Middlesex, gentleman. *For improvements in the manufacture of sugar from the cane.* Patent dated July 18, 1848.

These improvements refer to the refining of raw sugar, and to the clarifying, purifying, and refining of sugar-cane juice, by filtering it through cotton or other vegetable fibrous substances cut into short lengths. The cotton is cut into short lengths of from one-eighth to one-fourth of an inch, and the external gloss removed by immersing and repeatedly stirring it in boiling water. The filter preferred by the patentee, is a vessel "wider at top" (query, than what?) with a cork at bottom, and fitted in a frame capable of being moved up or down, furnished with cross pieces of wood over which is stretched a coarse cloth. In every 100 lbs. of raw sugar from 1 to 2 lbs. of cotton is used, which, when scalded, will weigh 7 lbs. This cotton is placed in the filter underneath the frame, and water poured on until it is nearly distributed over the bottom, which water runs out at the cock. 1000 lbs. of raw sugar are boiled up with from 500 to 600 lbs. by weight of water, 1 to 2 lbs. of chalk, and half a pound of starch "which last is not necessary, but beneficial," and the impurities skimmed off as they arise to the surface. It is then run into the filter, whereby the water is driven out, and subsequently flows out itself in a purified state. The cotton may be cleansed by washing and used again.

It is stated that this sugar is more agreeable to the taste, and, in consequence of the chalk being neutral, less uncrystallizable than what is prepared in any other way; and that as the sugar is used at the boiling point, when no fermentation can take place, and as the chalk neutralises the acids, no subsequent decomposition can take place. Also, that no surplus of chalk need be feared since the cotton will lay hold of and retain it, together with any azotic or impure matters. Instead of the raw sugar being filtered through cotton, the cotton may be boiled with it.

The preceding operations may be applied to refined sugar-cane juice previously cleansed and purified by caustic lime; but the patentee believes it to be better to substitute chalk in combination with the filtration through cotton.

Claim.—The use of cotton or other vegetable fibrous material (cotton, however, being preferred) cut into short lengths, in the refining of raw sugar, and to the cleaning, purifying, and refining of sugar-cane juice.

WILLIAM EDWARD NEWTON, Chancery-lane, Middlesex. *For certain improvements in machinery for letter-press printing.* (Communication.) Patent dated July 18, 1848.

This invention consists, 1. Of various modes of distributing the ink in even quantities to the inking rollers of a printing machine. 2. A Washington hand-press, in which the lever is of a peculiar form, so that as the pressman draws the handle towards him, the velocity decreases and the pressure increases. 3. A self-acting inking apparatus for inking the type in a hand-press as the frame travels in and out. 4. An apparatus for inking the type in a hand-press, which is worked independently, but in conjunction with the press, from any prime mover, and which the patentee states to be peculiarly applicable to fine printing.

4. A card-printing press, in which the inking and pressing are effected by the workman's foot, leaving his hands at liberty to feed in the cards, which, after they are printed, are delivered out of the other end of the press.

In consequence of this machine having been the subject of a former patent, granted to the same gentleman 12th May, 1847, he has not described its peculiar construction sufficiently in detail for us to give an intelligible account of it without reference to the former specification.

The claims, which are very numerous—nine under the first head alone—are all for the arrangement and combination of parts, or any modifications of them which constitute these different presses respectively.

ALEXANDRE EDOUARD LE MOLT, CHEVALIER, Conduit-street, Middlesex. *For certain improvements in apparatus for lighting by electricity; parts of which may be made use of in other applications of electricity.* Patent dated July 20, 1848.

This invention consists; 1st, of certain improvements in constructing galvanic or

electric piles for the production of light and other applications of electricity. 2nd. In the application of discs of carbon, so arranged as to revolve near each other, and, when they shall have completed one revolution, to approach and again to come into proper relation to each other.

The "improved" mode of constructing the electric piles, consists in employing, as one of the elements, a piece of carbon, which is produced by the destructive distillation of coal, or other substance, in the manufacture of carburetted hydrogen gas. This piece of carbon is electrotyped at one end, to which a strip of metal is soldered and riveted, or otherwise permanently attached, and the other end of the strip is fastened in like manner to a cylinder, composed of amalgamated zinc, which is the other element of the pile. The exterior surface of the cylinder, the metal strip, and the electrotyped end of the carbon element, are all coated with a varnish, to prevent or to modify the destructive action of the acids thereon, and also the influence of the zinc on the carbon. The varnish preferred is copal varnish, thickened by having retort carbon ground up fine with it. The carbon element is placed in a porous jar, filled with nitric acid. The amalgamated zinc cylinder is then placed over and encircles it, and the whole is placed in a stoneware jar filled with a solution of sulphuric acid, in the proportion of one part of the latter to seven of water. The carbon element may be cut out of the residuum of a gas retort, or may be moulded from a mixture composed of one part of coal, or coke, or charcoal powder, three parts of retort carbon, and one part of tar. This mixture is placed in suitable moulds, and subjected to great pressure in a hydraulic or other press. It is then removed and dried by the atmosphere in the shade, after which it is heated gradually in a close vessel for 36 hours, until it attains a bright red heat, on which it is allowed to cool, and is ready for use.

The disc or rotary electrodes should be of the purest carbon, and for this purpose the patentee prefers to employ retort carbon cut into proper shape and purified by immersion in a solution of nitric and muriatic acid for 12 hours, and afterwards in a solution of fluoric acid for a like period. The disc electrodes are mounted on suitable axes supported in the extremities of a kind of horse-shoe frame, which is jointed in the centre of the curved part so that the two arms are free to approach to or recede from each other. The horse-shoe frame is held vertically, and the electrodes rotate in the same plane, or in planes at right angles to each other. Through the joint of the horse-shoe frame passes an axle, driven by clockwork, and carrying a toothed wheel, which drives another toothed wheel keyed on to the axle of two chain wheels. Two chains are passed round these wheels, and round two others fixed upon the respective axes of the electrodes, whereby a uniform rotary motion is imparted to both of them. Above the chain wheels, and between the arms of the horseshoe frame, is mounted a toothed wheel, which is driven by the toothed wheel on the axle of the chain wheels, and carries on its exterior side surface a combination of cams, against which press two stops, fixed one on either arm of the horseshoe frame. A horizontal coiled spring is fastened at one end to one arm of the frame, and at the other to the second arm, whereby—when the discs have completed one revolution, and the recesses in the cams are brought opposite to their respective stops, so that they may take into them,—these arms, and consequently the electrodes which they carry, are caused to approach towards each other. A portion of one of the arms is constructed of a non-conducting substance.

Claims.—1. The employing of that description or quality of carbon which results from destructive (ly) distilling coal or other matter used in the manufacture of gas as one of the elements, in an electric or galvanic pile; the employment of carbon moulded, subjected to pressure, and manufactured as described; electrotyping the ends of the carbon elements; connecting the carbon elements with the other elements used, by soldering, or other permanent fixture.

2. The application of discs of carbon, as electrodes, so that they shall, when they have completed one revolution, be caused by the mechanism to approach towards each other, and produce a continuous electric light.

[M. Le Molt has cut somewhat of a figure lately as a claimant for the honour of being the first adaptor of the electric light to illuminating purposes. The preceding abstract of his enrolled specification furnishes the best of all possible evidence that his claims are without foundation He has invented literally nothing. His discs, his mode of causing the electrodes to approximate, and the use of graphite for the electrodes, are all old. (See *Mech. Mag.* vol. xlii., p. 25.

We were at first inclined to except his plan of protecting the electrodes by electrotyping, but we observe that Mr. Staite in his last specification (see *ante*, p. 79,) proposes to cover them with tin-foil, which is in effect the same thing.]

David Napier and James Murdoch Napier, York-road, Lambeth, engineers. *For improvements in mariners' compasses; also in barometers, and in certain other measuring instruments.* Patent dated 20th July, 1848.

The improvements sought to be secured under this patent, relate: 1. To mariners' compasses. 2. To barometers. 3. To a

tachometers; or instruments for ascertaining the speed of vessels through water, or the velocity of currents of water: and 4. To weigh bridges or platform weighing-machines.

1. The compass box is gimballed, as usual, and contains the compass card, which is bound by a brass hoop, to which grip pieces are soldered. Above, and resting upon the needles, is a thin disc of "talc-brass," to which is fastened a disc of cotton or velvet, or other soft substance. A printed or ruled piece of paper, containing 24 concentric circles, and a number of radiating lines corresponding with the points or parts of points in a compass card, is temporarily held in the grips above the talc-brass and soft substance. Underneath the compass card there are three branches fixed to a loose collar on the spindle of the point, so that they may be slid up and down to serve as abutments or supports to the card. A lever is connected at one extremity with a vibrating frame, and carries at the other a vertical pricker, which is made to travel over the surface of the paper from the inner concentric circle to the outer one, and in a line parallel with the keel of the vessel, once in twenty-four hours. The lever is made to rise and fall, and consequently the pricker to puncture the paper at certain regular intervals of time, and th branches to rise up and support the card each time the puncture is effected. By this arrangement, the direction of the ship's course will be indicated by the punctures on the radiating lines, and the time by those upon the concentric circles. The lever, together with its pricker, and the branches, are actuated by ordinary clock-work machinery, which is carried in the bottom of the compass box, by means of a peculiar combination of toothed gear and levers. The printed paper is, of course, changed every twenty-four hours.

2. The improved barometer is constructed with a vertical spindle which carries a card, having on its surface a number of concentric circles which represent portions of time, and radiating lines which represent fractions of inches. Above the card is a lever carrying a vertical pricker, which is made to rise and fall at certain regular intervals of time, and to travel from the inner concentric circle to the outer one once in twenty-four hours. On the vertical spindle, and underneath the card, is fastened a grooved wheel, round which is passed a cord. A counterbalance weight is attached to one end of the cord, while the other one is made fast to a float resting upon a column of mercury in a tube. The card has a fixed point representing 29·5 inches, which, at commencement, is placed underneath the pricker. As the column of mercury falls or rises the printed card will travel to the right or to the left accordingly, and its variations of height be indicated by the distance of the punctured lines from the starting point, on either side.

3. The improved tachometer, or apparatus, for measuring the speed of vessels through the water, and the velocity of a current of water, consists of a horizontal spindle moving freely on pivots attached to the side of the vessel beneath the water-line, and inclosed in a case open at both ends. The spindle is fitted with vanes, the pitch of which is regulated so that ten revolutions of the vane spindles shall equal one fathom. The vane spindle carries a tangent screw, which gears into a toothed wheel keyed on the end of a shaft which passes into the interior of the vessel, whereby the number of nautical miles is marked in units, &c., up to 10,000 on ordinary indicating dials through the medium of trains, such as are used in gas meters, with the addition of four spring barrels, whose especial office it is to work the indicating dials and trains, and diminish the friction of the different parts so as to relieve the vane spindle from this duty, whereby the speed of the vessel, or velocity of the current, will be more correctly indicated and registered. The spring barrels have no effect of themselves upon the dials and gearing, but appear to facilitate the action of the vane spindle thereon. We say "appear," for we observe with regret that the relative connection of these barrels with the rest of the apparatus are anything but clearly and distinctly described, although they constitute the novelty of this portion of the invention, and form the subject of a separate claim.

4. The platform of the improved weighbridge is supported upon a horizontal cross bar attached to the lower end of a vertical bar, which is made fast at top to the end of a horizontal lever, whereby the platform is supported on a centre. The weight to balance the platform, with the goods thereon, is hung upon this horizontal lever, which carries a short upright, attached to a shorter horizontal lever, which is placed above and parallel to the first. The other end of the short lever is pivoted loosely to a standard of the frame, and has above it a coiled spring. From the top end of the short upright is a chain, which passes over a pulley, suspended between friction rollers, and terminating in a weight that balances the connecting pieces, This pulley is keyed on a rod, to the end of which is attached a pointer, whereby the weight of goods on the platform is indicated on a dial; while, at the same time, a paper is made to travel underneath a pencil, so that the weight is also at the same time registered.

Claims.—1. The combination of suitable apparatus with a maintaining power, so as to produce a self-acting means of registering the direction of the head of the vessel, as indicated by the magnetic needle.

2. The method of registering upon a circular disc by a travelling point or pencil, as applied to barometers, and described.

3. The combination of a supplementary or auxiliary power, with apparatus for indicating and registering the speed of a vessel through the water, and the velocity of currents of water.

4. The measuring and registering of weight by a weigh-bridge or platform machine, having attached thereto apparatus such as described.

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal.*]

FOR AN IMPROVEMENT IN MAKING CANDLES. *B. F. Shellabarger.*

Claim.—The manner in which I form the candles, point them, and cut them to a suitable length at one operation, by means of the cylinder, piston, wick-tube, moulding-tube, grooved pulley, axles, and connecting band; the cutter wheel, curved cutter, and conical spiral cutter, combined and operating with each other.

Also the manner of preparing the tallow, or other suitable material for moulding in a cold state, by cutting it into thin slices, previous to placing it in the cylinder, for the purpose of giving equal solidity to the candles, and uniformity of appearance.

FOR AN IMPROVEMENT IN ROTARY STEAM ENGINES. *James Black.*

The nature of the invention consists in constructing a steam wheel with a double series of curved buckets, secured to its periphery, closed at their sides, and divided by a central division plate, with the spaces between the series of buckets on each side of the division plate connected by curved apertures; and the arranging the steam wheel within an enclosing casing, in such a manner that steam admitted to the buckets on one side of the central division plate, will act directly upon the wheel, by impinging upon the face of the buckets, and descending to the base of the same, will pass through the connecting apertures to the series of buckets on the opposite side of the division plate, and in escaping from between which, it will react upon the face of the buckets, and give additional impetus to the wheel.

Claim.—The double series of curved buckets upon the steam wheel, with the spaces between the same, united as described, combined with the steam pipe, by means of the segment.

FOR AN IMPROVEMENT IN WATER-WHEELS.—*Uriah A. Boyden.*

Claims.—1. Fastening conical or bell-shaped rings to the circumference, or outer edges of the rings or rims of turbine wheels and reacting water-wheels, which the floats are attached to, or making the rings or rims which the floats are attached to, of so large a diameter, as to extend outward beyond the outer extremities of the floats or buckets, and making the part of one or of both of the rings or rims which are outside of the floats, curved, conical, bell-shaped, or of such other form, that the distance between them at their exterior edges or circumferences shall be greater than at the parts next the outer extremities of the floats. I do not limit my claim exactly to the width or forms described, but extend it to all forms which are essentially the same as those described. I do not include in this claim the placing bell-shaped rings around the circumferences of wheels, detached and separate from the wheels; but I claim these adjuncts so attached to the wheels as to revolve with the wheels,or so made as to be parts of thewheels.

2. Making the parts of the tops of the leading curves at and near the garniture, sloping; though I do not confine my claim exactly to the angle of slope described, but extend it to all slopes of any angle, inclination, curvature, and extent which will in any degree answer the same purpose.

FOR AN IMPROVEMENT IN CUTTING FILES. *Richard Walker.*

The nature of the invention consists in constructing a machine to cut two sides of a file at the same time, and by one and the same motion, by pressure on the chisels, instead of a blow by a hammer, the power of pressure being a suspended weight, arranged in such a manner as to give any required depth of cut in a more regular and uniform way than by a blow, or otherwise.

Claim.—The combination of the weight, cam, slide, and dog, with the carriage, toggle joint, and cutter levers, for the purpose of cutting files by pressure.

The Pesth Suspension Bridge which is erected over the Danube at Pesth, was commenced in 1840, according to the designs and under the direction of Wm. Tierney Clark, Esq., civil engineer, (the same gentleman who designed our Hammersmith-bridge) and has just been completed at a cost of £650,000. This bridge, which for magnitude of design and beauty of proportions stands first among suspension bridges, has a clear waterway of 1,250 feet, the centre span or opening being 670 feet. The height of the suspension towers from the foundation is 200 feet, being founded in 50 feet of water. The sectional area of the suspending chains is 520 square inches of wrought iron, and the total weight of the same 1,300 tons. This is the first permanent bridge since the time of the Romans which has been erected over the Danube below Vienna, it having been considered impossible to fix the foundations in so rapid a river, subject to such extensive floods, and exposed to the enormous force of the ice in the winter season. It now, however, stands as another monument of the skill and perseverance

of our countrymen. The bridge was opened for the first time, not to an ordinary public, but to a retreating army, on the 5th of January, 1849, by which the stability of the structure was put to the most severe test, which cannot be better described than by referring to the letter of a correspondent, who writes—"First came the Hungarians in full retreat and in the greatest disorder, hotly pursued by the victorious Imperialists; squadrons of cavalry and artillery in full gallop, backed by thousands of infantry—in fact, the whole platform one mass of moving soldiers; and during the first two days, 60,000 Imperial troops, with 270 pieces of cannon, passed over the bridge." This fact cannot but be of importance to the scientific world, since it proves that suspension bridges, when properly constructed and trussed according to the design of Mr. Clark, may be erected in the most exposed places, while their cost in comparison with stone bridges is comparatively insignificant.—*From the Times.*

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Boggett, of St. Martin's-lane, Middlesex, manufacturer, for improvements in methods and machinery for obtaining and applying motive power. January 20; six months.

Henry Bernoulli Barlow, of Manchester, for improvements in the manufacture of pile-cut fabrics, and in machinery or apparatus applicable thereto. (Being a communication.) January 20; six months.

Samuel Brown, the younger, of Lambeth, Surrey, engineer, for improved apparatuses for measuring and registering the flow of liquids and of substances in a running state, which apparatuses are in part also applicable to motive purposes. January 20; six months.

Henry Needham, of Vine-street, Piccadilly, Westminster, gun-maker, for certain improvements in fire arms. January 20; six months.

Thomas Robinson, of Leeds, flax-dresser, for improvements in machinery for breaking, scratching, cutting, heckling, dressing, combing, carding, drawing, roving, and spinning flax, hemp, tow, wool, silk, and other fibrous substances, and in uniting fibrous substances. January 23; six months.

Charles de Bergue, of Arthur-street West, London, engineer, for improvements in steam engines, in pumps, and in springs for railway and other purposes. January 23; six months.

Edward Slaughter, of the Avonside Iron Works, Bristol, engineer, for improvements in marine steam engines. January 23; six months.

Rees Reece, of London, chemist, for improvements in heating peat and obtaining products therefrom. January 24; six months.

Charles Henry Paris, of Paris, France, for improvements in preventing the oxidation of iron. (Being a communication.) January 23; six months.

William Henry Barlow, of Derby, for improvements in the construction of permanent ways for railways. January 23; six months.

Richard Johnson, of Blackburn, Lancashire, gentleman, for certain improvements in the manufacture of malted grain, and in vinous fermentation; also improvements in brewing, and in the machinery or apparatus connected with the above or similar processes. January 23; six months.

Wakefield Pim, of the Borough of Kingston-upon-Hull, engine and boiler maker, for certain improvements in propelling ships or vessels. January 25; six months.

Robert Shaw, of Portlaw, Waterford, cotton spinner, and Samuel Fletcher Cottam, of Manchester, machinist, for certain improvements in machinery for preparing spinning and doubling cotton, wool, flax, silk, and similar fibrous materials. January 25; six months.

John Talbot Tyler, of the firm of Ashmead and Tyler, Mount-street, Grosvenor-square, hatters, for certain improvements in hats, caps, and hat-cases. January 25; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Jan. 19	1737	William Hattersley	Ratcliff Highway East	Passengers signal light.
20	1738	Josh. Tayler and Son	Warwick-lane	Improved ball-cock.
„	1739	H. I. Nicoll and D. Nicoll	Regent-street	Coats.
„	1740	Edward Frisby	Marylebone-street	Paragon boot-heel.
22	1741	Thomas Craddock	Birmingham	Pressure gauge.
„	1742	William K. Harvey	Blurton	Apparatus for cleaning potter's materials from particles of iron.
23	1743	T. H. Busbridge and G. F. Busbridge	East Malling Mills, Kent	Dandy rollers for paper-making.
„	1744	James Tasker	Liverpool	Anti-collision signal lamp for shipping and boats.
„	1745	John Hartley	The Mills, Otley, Yorkshire	Improved mill.

NOTICES TO CORRESPONDENTS.

A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the Claims of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d. Postoffice Orders to be made payable at the Strand Office, to Joseph Clinton Robertson, of 166, Fleet-street.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co. Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1330.] SATURDAY, FEBRUARY 3, 1849. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

STENSON'S PATENT IMPROVEMENTS IN STEAM ENGINES AND BOILERS.

Fig. 2.

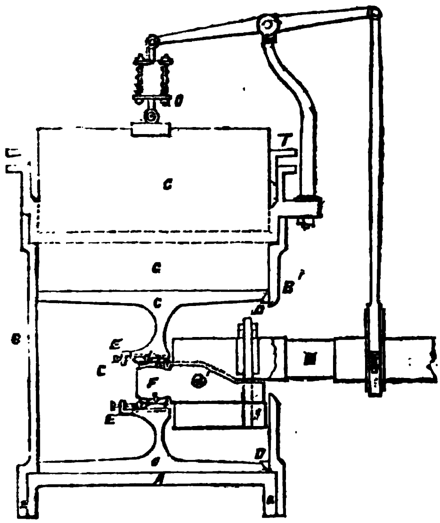


Fig. 1.

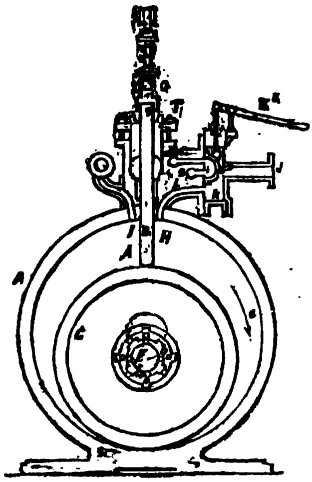


Fig. 3.

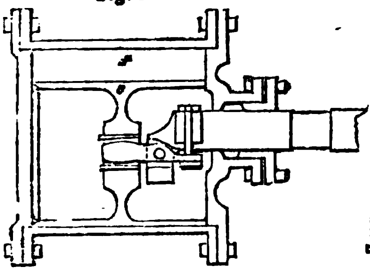


Fig. 4ª.

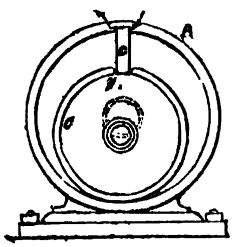


Fig. 5.

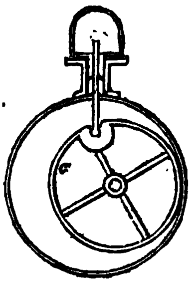


Fig 6.

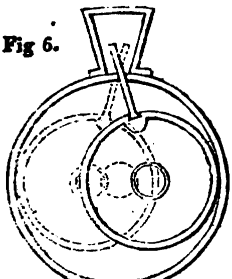
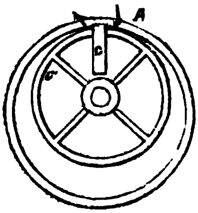


Fig. 4.



We have already given Mr. Stenson's claims (see *ante* p. 68,) and now propose to select from his specification some of the more prominent of its contents.

Rotary Engines. (Claim First.)

Fig. 1 is a transverse section of a rotary engine constructed according to this part of my invention, and fig. 2 is a longitudinal section of the same. A is a metal cylinder with flanges, *a a*, on its two ends; B, B′, are two covers which fit closely upon the flanges, *a a*; C is a hollow roller which is placed inside of the cylinder A, and serves, as afterwards explained, the office of a piston; it is of the same length as the cylinder between the end covers, B, B′, but is about one-third less in diameter. The ends of this roller are turned and fitted truly to the cylinder, A, but one of these ends is bevelled inwards (see fig. 2) and a metallic ring, D, of a triangular section is inserted between the said bevelled edge, and the straight side of the cylinder which serves as a steam-tight packing at that part. M is a working shaft, with fly-wheel attached, (not shown in the figures) the inner end of which shaft is cranked and passed through an opening in the cover, B′, into the interior of the roller, C. To the cranked end of this shaft there is a pin, F, attached by joint-screw pins, d^1 and d^2, the inner end of which is of the rounded form shown in the figures, and fits into a hole of a corresponding shape in the central boss of the roller C, where it is gripped and held in its place by the brasses, *b*, *b*, wedges, *d*, *d*, and screw bolts, E E (see fig. 2), so that the roller may turn freely on the crank pin, F, as its axis or bearing. The pin F is free to vibrate to a small extent on the joint pin, d^1, but is kept at the same time tight up to the fly-shaft, M, by the other joint pin, d^2, which is fitted with a spring for that purpose. While on the one hand, therefore, the action of the screw bolts, E E, upon the wedges, *d d*, and brasses, *b b*, serves to keep the piston roller, C, central to the crank pin, F, so on the other hand, the action of the spring screw pin, d^2, has a constant tendency to keep the periphery of the piston roller C, in close contact with the inner surface of the cylinder, A, and so to prevent any escape of steam between them. The brasses, *b b*, and wedges, *d d*, are prevented from turning on their centres independently of the crank pin, F, by feathers fitting into corresponding grooves in the member represented in the vertical section, fig. 1. G is a sliding, diaphragm or plate, which works through a slot in one side of the cylinder, A, on a vertical line with its axis, and is kept always in close, though varying contact with the piston roller, C, by means of a weight or spring, or (which I prefer) by means of a lever movement working by a cam or eccentric fixed on the fly-shaft, M, and acting on the upper edge of the plate at O. T T is a stuffing box to the diaphragm, G. As this diaphragm is kept always in contact with the piston roller, C, on one side, and that roller is in constant contact with some other part of the cylinder, A, there is a complete separation effected of the cylinder lengthwise into two parts, or chambers indicated by the letters H and I; J is an induction pipe, which conveys the steam from the boiler to the steam chest, K, whence it is admitted by a slide valve into a chamber L, from which it passes through a number of orifices, *l l l*, (the united areas of which are equal to the area of the induction pipe, J,) into the division H, of the cylinder A. As there is no way of escape for the steam so admitted, either at top or bottom of the cylinder—being stopped at top by the fixed diaphragm or abutment, G, (that is to say, fixed in respect of lateral position,) and at bottom or some other part of the cylinder by the contact between the piston roller, C, and the cylinder—but as the roller is free to revolve within the cylinder, the pressure of the steam against the yielding roller, forces it round in the direction indicated by the arrow, *e*. The roller as it rotates, drives before it any air or steam there may be in the chamber I, and compels it to make its exit through the eduction-pipe, N, which is connected to the port, *z*, and close to the side of the diaphragm, opposite to that at which the steam is admitted, till on passing the mouth of the induction pipe, and over the central axial line of the cylinder (the diaphragm yielding for the moment to the upward pressure of the roller) and also past the mouths (*l*, *l*, *l*) of the induction pipe J, the diaphragm

G, once more descends, and fresh steam being admitted between it and the piston causes the latter to continue its rotation as before. It will be obvious therefore that all that is necessary to keep up a continuous rotation of the piston-roller, C, with the least expenditure of steam practicable, is to admit (by means of the slides and the usual appendages to slides) the steam at proper intervals, and in suitable quantities, which two elements in the calculation, depend jointly on the amount of free steam space left in the cylinder, and the degree of expansion at which it may be deemed advantageous to work the steam.

In the preceding description the engine has been supposed to rotate from right to left, but the valve-box is so adjusted that the direction of motion may be changed at pleasure, from left to right. All that is necessary for this purpose is, to lower the slide-valve, D^2, by means of the lever, E^2, so that it may cover the lower parts, L^2 and s, instead of the two upper ports, z and s, when that which was in the first instance the eduction passage becomes the induction one, and *vice versâ*.

Another modification of this engine is exhibited in fig. 3 (a longitudinal section) and fig. 4 and 4^a (transverse sections). The parts in this case, and their respective forms and offices are the same as in the engine first described with the following exceptions. First, the opening left in the right-hand cylinder cover, is closed by a stuffing-box, through which the cranked working shaft is passed. Second, the diaphragm, G, instead of sliding up and down as before described, is a fixture which projects inwards from the inner periphery of the cylinder, A, and enters at its lower extremity into a recess in the periphery of the piston roller. And, third, the piston-roller, C, is caused by the eccentric action of the cranked shaft, to which it is attached, to describe such a path, in respect of the steam cylinder, as to open and shut alternately the steam induction and eduction passages, and thereby to produce a continuous rotation of the cranked or working shaft.

Fig. 5, shows a modification in which the diaphragm is connected by a knuckle joint in the piston roller, C, and works through a stuffing-box covered by a hood. Or instead of the diaphragm being a fixture attached to the cylinder, it may be a fixture attached to the piston-roller, and work through a slot in the cylinder; this slot being covered in with a hood or case, as represented in fig. 6.

(*To be continued in our next.*)

GERMAN EXPERIMENTS ON THE INSULATING PROPERTIES OF GUTTA PERCHA-COVERED ELECTRIC WIRES. BY MR. WERNER SIEMENS.

Sir,—Having read a report in the *Times* newspaper of some experiments which have lately been made by the South Eastern Railway Company at Folkestone Harbour, under the direction of Mr. Walker, with the view of determining the insulating power of a gutta percha coating upon electric conducting wires, I feel myself called upon to place before the public an account of similar and very conclusive experiments which have lately been tried on a large scale by the Prussian government, under the direction of Mr. Werner Siemens, an officer of the Prussian arsenal; and I wish to avail myself of your valuable assistance for that purpose, knowing how deeply you feel interested in the progress of the science of electric engineering.

During the winter 1846-7, Mr. W. Siemens commenced his experiments upon the insulating property of gutta percha, caoutchouc, and other similar substances, endeavouring to give the line wire of his peculiar electric telegraph a coating which would effectually insulate it from the earth in which it should be interred. At that time he obtained a patent in Prussia for his electric telegraph, which is considered quite peculiar, and differing from any other, inasmuch as it constitutes of itself a complete electric machine, the electric fluid being the sole motor, its own regulator, and printer—the advantages whereof are, that it accommodates itself to all irregularities of battery power (provided that power does not fall below a certain minimum); that it profits to a certain extent by bad currents, is very easily managed, and requires but one line wire.

In the summer of 1847, Mr. Siemens obtained permission to try his telegraph upon an established line between Berlin and Potsdam (a distance of about 15 English miles), where it has since been permanently adopted, in preference to the needle telegraph which had been

previously used. In order to remove a general prejudice against the introduction of electric telegraphs, on account of the great expense incurred in suspending, maintaining, and guarding the line wire above ground, and from fear of frequent interruption by heavy rains, tempests, or mischief, Mr. Siemens renewed with increased vigour his experiments on insulating wires. Gutta percha appeared to him objectionable on account of its tendency to become a hydrate, in which state it is an electric conductor; he therefore tried a wire, four miles long, coated with caoutchouc, which was interred thirty inches below the surface of the earth. The insulation, however, was imperfect; and having improved his method of rendering gutta percha free of water, and also of laying it upon the wire (between grooved rollers), he returned to that substance, and completed a length of thirteen English miles, which was interred thirty inches below the surface of the earth, along the railway between Berlin and Grossbeeren. The coating of this line of wire was imperfect at a few places, which, however, by means of a novel process of induction, were soon discovered and soldered up; it has been in constant use ever since (about eighteen months), and still continues to give perfect satisfaction.

In March, 1848, an opportunity presented itself to subject the gutta percha coating to a severer trial. The Provisional Government of Schleswig Holstein called upon Mr. Siemens, in conjunction with Professor Himly, to protect the harbour of Kiel against hostile men-of-war.

The pressure of time did not admit of extensive preparations. Large bags were made of gutta percha, each containing between 2000 and 3000 lbs. (avoirdupois) of gunpowder. They were hermetically sealed, and sunk by means of ballast, at various points into the deep water channel. Each of them was provided with an earth wire and a conducting wire, leading along the bottom of the sea to a central station, where each mine could be fired at pleasure, in order to destroy any hostile vessel which came within its reach. Instruments were so placed as to indicate the exact position of each mine to the guard on duty. These wires were tested from time to time, and it was found that they continued in good condition for several months; but by degrees they changed in appearance, and after having been immersed in the sea for six months, the gutta percha was converted into a complete hydrate, and altogether dispossessed of its insulating property. Coated wires which have been immersed in fresh water for the same length of time, have also clearly indicated some change, but only in a very slight degree. These results caused Mr. Siemens to try fresh experiments; and he finally succeeded in preparing a gutta percha composition, which, as far as his experiments go to prove, has no affinity for water.

So strong, indeed, is the faith of the Prussian government's Electric Committee in the success of this coating, that they have adopted it for all their lines in course of construction. Mr. Siemens has just completed a telegraphic communication between Berlin and Frankfort-on-the-Maine (a distance of 445 English miles), and another line from Berlin to Cologne is completed as far as Magdeburg. In Hanover, and other states of Germany, the same description of telegraph has also been adopted.

This great length of copper wire is coated by means of one single machine which has been constructed by Mr. Siemens and a Mr. Halske conjunctively. It consists of a horizontal cylinder, with a moveable piston; a chamber at the end of this cylinder is pierced with sixteen holes, eight of which are through the bottom, and of the same diameter as the wire itself; the remaining eight are through the top side, exactly opposite to those in the bottom, and are of the intended diameter of the coated wire. Eight separate wires are pointed through the bottom holes; the cylinder is moderately heated, and filled with the gutta percha composition, whereupon the piston is urged forward, and, in forcing the semifluid substance through the eight larger holes, it carries with it the coated wires with remarkable velocity, the wire itself being impelled by virtue of adhesion to the gutta percha which surrounds it.

In going through large rivers, such as the Elbe, the Weser, and others, Mr. Siemens has encased the coated wire in iron pipes, in order to protect it from damage.

In concluding this communication—which I fear already exceeds the limits of your valuable space—I beg to say that

on another occasion I shall feel pleasure in furnishing you with a description of Mr. Werner Siemens' electric telegraph, which is not yet publicly known, although it has for two years and more been privately adopted in Germany, and is at present making rapid progress, in consequence of its success at a public competition which took place at Berlin last March, before the Government Commissioners. I am, Sir, yours, &c.,

A FRIEND OF PROGRESS.

Birmingham, Jan. 24, 1849.

DESCRIPTION OF A SERPENTINE OR VERMICULAR BARGE CONSTRUCTED BY THE LATE BRIG.-GEN. SIR SAMUEL BENTHAM, FOR THE EMPRESS CATHARINE II. BY THE LATE JEREMY BENTHAM.

[The following letter, written by Jeremy Bentham (the elder brother of Sir Samuel Bentham), describes a vessel of a very peculiar construction, which may be considered more in the light of a curiosity than as an invention of general utility, now that steam has given us the power of navigating with facility, the most tortuous and shallow rivers; yet, very possibly, there may still be countries and circumstances, in which water conveyance could be effected by means of such a vessel, when it could not be accomplished in any other way.

Mr. Bentham has omitted to say that the Imperial Vermicular drew but *four inches* of water when light, and no more than *six inches* with its 124 rowers, stores, &c., on board.

Some subordinate inventions are mentioned in the course of this description which may be considered (the progress of steam notwithstanding) as still of very general application. Such are the two slender masts forming a triangle, with a stay rope—the rudder at the head, as well as at the stern, an improvement subsequently exemplified in one of the war schooners, of 1795, and more recently in the *Janus* Government vessel, and some of the Thames steamers—the stem of the rudder in the middle, instead of at one edge of it,—and the double row of rowers so as not to interfere with one another.

The day's delay for provisions frustrated the purpose for which the imperial barge was built. The empress, Catharine II., tired of the tediousness with which the barges proceeded, that had been built at St. Petersburgh for her use, pursued her journey by land, having left Kioff two hours before Sir Samuel's arrival there. The Emperor of Germany (Joseph) went on board, when, during his visit, the Vermicular, was rowed round so as to form a ring, the head joining the stern; after which, it was allowed to resume a straight line, and left to the influence of the stream.

Zadobras, near Crickoff,
Monday, May 3-14, 1787.

Honoured Sir,—I am now alone; my brother is before this, I hope, at Kioff, or on his way from thence to Cherson. I left him on Thursday se'nnight at Propoisk, a town upon the Soje, about 40 miles from hence by land, but double or treble the way by water, pursuing his course on board his new-invented Serpentine or Vermicular Barge, whichever you please to call it. Of this barge you will expect some description. It consists of six different boats, connected together by a particular mechanism, so as to form but one, but pliable in every direction in the manner of a snake. Each boat, or link, as we call it, is 42 feet in length, consequently the length of the whole is 252 feet; the two head links are taken up entirely with oars, as is the forehalf of the third and the whole of the sixth. In the first link are 36 oars; in the second, 40; in the rowing part of the third, 20; in the sixth, 24; in all 120, besides two at the head of the head link, and as many at the tail of the tail link, to answer the purpose of rudders. There are two ranks of oars on each side, consequently four are seen of a row when you look across the boat; the back half of the third link, and the whole of the fourth and fifth constitute the habitable part of the barge, which I must lose no time in telling you is destined for her Majesty's use, if she will vouchsafe to set foot in it. The breadth of this habitable part is, throughout, 13 feet 5 inches in the inside; on the outside, from the bottom of the windows, the breadth is continued on each side 1 foot 8 inches, which breadth forms a platform or foot-board, for people to walk on, in passing from the head rowing links to the rowing link at the tail behind the habitable part, consequently the extreme breadth is about 16 feet 9 inches. From this foot-board to the floor of the rooms in depth, and from the side of the rooms to the side of the boat (that is, the breadth of the foot-

board) in breadth, forms a space all along, which, opening into the rooms, affords a continued range of cupboards on each side. Height of the rooms, 7 feet 4 inches in the middle; 6 feet 7 inches at each side. The difference is occasioned by the form of the roof, which, of course, is a little arched for the sake of strength, that upon occasion it may bear a man. The front room occupying only the hinder half of the third link on which it stands, forms the anti-room for attendants; that immediately behind it occupies the whole of the fourth, and forms the dining-room. Of the fifth link, the front half forms a drawing-room or dressing-room, which ever you please to call it, into which her majesty, with a select party, may withdraw from the dining-room; behind the drawing or dressing-room is the bed-chamber, with two cabins for attendants and other conveniences: the place for the bed is an alcove taken out of the breadth, and occupying the middle part of that breadth; just at the hind part of the link fronting it, is a very neat cabin stove, in the English taste, made on purpose. The whole length of the room is filled with windows on each side, separated only by panels of six inches wide; height of the windows, three feet all along; width of each window, two feet and a half—to each window four panes; the wood-work very light: the windows draw up and down, and there is a blind to each of them that does the same. Between the anti-room and the dining-room there is necessarily a space of two or three feet or more, to give room for managing the junction of the two links; so, for the same reason, is there between the dining-room link and the link which contains the drawing or dressing-room and bed-chambers.

A little short of the extremity of the first link stands a half octagon platform, about 4½ inches above the rowers' seats; on this my brother stands to give orders with a speaking-trumpet, of which you may imagine there is some need, as the length of the whole barge is above a quarter as long again as that of your garden. A semicircular rail, covered with scarlet cloth, and standing on three pillars rising from the platform, serves for his support; fronting this platform, at the other end of the barge, is a platform somewhat similar, for the same purpose.

The third, fourth, and fifth link being left out, the first, second, and sixth form a princely rowing boat; in that case, her Majesty may seat herself on a sofa towards the stern, formed of a neat kind of platted work of red, edged with chocolate colour (the colour of Wedgwood's ware), with cushions of stuffed leather.

Of the mode of junction I know not how to give you any tolerable idea; I do not perfectly understand it myself, the mechanism being mostly concealed by the structure of the parts. The stern of the head link, for example, is concave; the head of the second link is convex, fitting exactly into that cavity. In the concavity between the upper edge of the boat and the water, runs an horizontal groove; the connection is formed by an iron bar, which is fixed in the second link, playing, turning, I believe, there round a perpendicular fulcrum, and running upon friction-rollers in the horizontal groove; in the breech of the first link the length of the bar is divided, as it were, by a hinge, which, lying horizontally parallel to the horizontal groove, of course gives room for that part of the bar that is not fixed to the end of the bar opposite to that which is fixed, to play up and down, according to the motion of the link boat into which it is inserted by means of the horizontal groove. The hinge is just perceived as you look down between the two links (boats), and the diameter of it forms, I think, all the interval which there is in general between them; but they are capable, upon occasion, of being let out—to I don't know what distance—I believe a foot or more: all the other links are connected in the same manner.

Instead of a long boat, the barge has a 24-oared boat of one link, but in other respects constructed upon the same principles,—six rows of rowers in length, four in breadth, being very shallow (drawing very little water). It goes with great swiftness, notwithstanding its great breadth; being so broad, it is as steady as *terra firma*, and will turn round like a top that sleeps, without changing its situation. There is likewise a four-oared boat, not much unlike our common wherries. As for the great barge, there has been no opportunity of trying its swiftness, nor can there be till it goes fairly into the Dnieper; the Soje is so full of short turnings, and shoals, and stumps of branches of trees, projecting, some above the water, others a little way below the surface—the inundation being not yet over, nor the natural bed of the river ascertainable. One of the turnings, I observed, was so short as to form much less than a right angle—my brother thought not so much as half such an angle. It was curious to observe the barge bending itself to that form: had it been inflexible, it could not have passed the turning.

When the construction of the barge was too far advanced to admit of any alteration, my brother thought of another mode of junction much more simple than the foregoing, and consequently, if it succeeds,

much preferable. He took with him a vessel of three links constructed upon this principle, and which he hopes will live in the Black Sea. The ends are quite square, like those of a box, and the junction is effected by two ropes crossing one another thus ×. One end of each rope is fixed in one link, and the other in the contiguous link. Beams slide out—I can't recollect how—to keep the two links asunder when and at what part it may be found necessary.

Dimensions of the Sea Vermicular.

	F.	I.		F.	I.	
Breadth	14	0	Bottom	0	3	The timbers 8 ins. square; the bottom and sides connected by dovetailing.
Middle link	34	6	Thickness of the planks at the sides	0	2½	
Length of the fore and after links	36	6	Thickness of the planks at the deck	0	2	

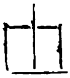
This serves for the present voyage as a sort of tender to the great Imperial Vermicular, containing some baggage, washerwomen, and other followers.

Besides the above, there is another experimental vessel upon the same simple plan, but much larger in its dimensions, designed only for fresh water, and calculated chiefly for the conveyance of timber. It consists of five links, three of them hollow, and the other two solid, composed of timbers packed up together into a mass of the same breadth as the hollow links, and designed to sink in the water to the same depth. These solid ones being built at a different place from the others, I did not see them.

	Feet.
Breadth of all the links	32
Length of the middle link	70
Length of the fore and aft links	51

The hollow links were to hold planks.
It was not in readiness to accompany my brother, but was to set out after him, from a place at some distance from hence, as yesterday.

Of the number of oars to these vulgar vessels, I cannot speak with any certainty, my attention having been so much taken up with the imperial one; the actual number was limited to the number of hands that could be spared, but double rows could be stowed the whole length—the habitable and stowage part being under deck.

I should never have done if I attempted the describing all the subordinate contrivances, for these vessels differ from all others in almost every particular that can be imagined. For example, instead of a large mast as in common, two slender masts forming a triangle with a thick rope that stays them. Of the two rudders which the sea vermicular and timber vermicular are each provided with, one at the head, the other at the tail—in one, I forget which, the staff is set down in the middle of the broad part, thus  instead of the side, as in common rudders thus.  This was for a reason which seamen will readily apprehend, and which I apprehended at the time but have since forgotten.

The great principle upon which the advantage expected from this construction in point of swiftness depends, is, that according to a maxim received, my brother says, by all ship builders, theoretically as well as practically, a vessel meets with no sensible retardment from its length. But by increasing the length, you may increase indefinitely the number of rowers, and consequently the moving force, while the increase of length, as far as the above maxim holds good, makes no sensible addition to the resistance. What sets limits to the length in all plans of construction hitherto known, is the vessel's capacity of holding together without falling to pieces by its own weight, which is called hogging by seamen. My brother does not know that anybody before him, ever put two rows of rowers close together on the same side they row without interfering with one another in the least.

Of the particulars contained in the above description, scarce any were furnished me by my brother; his attention was sufficiently taken up partly by an ague, partly by the conducting of these unexampled and untried vessels, with a crew perfectly raw and unexperienced through a navigation rendered as dangerous by sunken or projecting stumps as a sea navigation by sunken rocks.

When I embarked, he had had his ague about ten days, and he was so weakened by it, as to be unabled to stand and sometimes to speak, even when the fit was not on him, but in the course of the time I stayed with

him on board, which was two days and two nights, for he was kept waiting one day for the men's provisions, I had the satisfaction of seeing him considerably strengthened, and I hope the ague gone. When he was incapable of business, which was the case for several days, everything was either at a stand or going wrong—nobody capable of supplying his place in a business so new and so much his own.

Fear of being distanced by the Empress hurried him away in this condition, before the fitting up of the habitable part was finished; he took a number of the hands aboard with him for that purpose, and they were working as much at their ease as on dry land. The hold given to the wind, by the necessary height of the habitable part above the water, was a great difficulty to contend with in a stormy part of the year, through so confined and winding a channel, rendered only the more dangerous by spending itself occasionally at this season of inundation over underwood and sand-banks.

HORÆ ALGEBRAICÆ. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

(Concluded from p. 36.)

XII. CONCLUSION.

If the reader will recur to the first of these *Horæ*, he will find (vol. xlvii., p. 14) a problem in which the rule previously laid down, for the selection of appropriate algebraical results, utterly fails to conduct us to such results, and even leads us into error. This circumstance may be explained as follows: Suppose that it is required to solve two quadratics, each involving x and y. From either of them we may obtain, in general, an equation of the form,

$$x = ay \pm \sqrt{by^2 + cy + d},$$

Next suppose that, in the actual solution of the problem, we have determined a value, e, of x. Then we have

$$e = ay \pm \sqrt{by^2 + cy + d},$$

where e is known. But, in such a case as the present, the application of the rule in question affords us no results capable of being relied on. For, if we attempt to determine the sign of the radical in the last equation by extrinsic conditions, we may be led to give it a sign inconsistent with that which the very supposition of the existence of such an equation renders necessary. The sign to be given to the radical is to be determined by the method given in the last volume of this Journal (pp. 518—521) and not by collateral considerations. Of course it will sometimes admit of either value. The discussion just alluded to will supersede that given at pp. 135—6 of vol. xlvii., and will probably serve to elucidate a remark which I made at p. 332 of the latter volume. It is, however, hardly worth while to dilate upon the subject. The reader will observe that, in what precedes, I have not regarded the impossible equations as in any way available. Nor in fact are they so considered in the discussion of the problems which occur in the text books of Algebra. It is possible (that is to say, real or unreal) solutions that are the objects of the exercises of the books. But, if we introduce into Algebra a symbol of impossibility, then any surd equation whatever has a symbolic solution.

I cannot avoid repeating here a distinction which I have already noticed (vol. xlvi., p. 245), and which had previously been applied to important purposes by Professor J. R. Young, I mean the distinction between what I propose to call *isolated* and *continuous* zeros. Of the former—the isolated zero—the symbolic representation is

$$a - a;$$

of the latter the symbolic representation is

$$\frac{1}{\infty};$$

and between these symbols there is a great difference to which I shall, in a future communication, call attention. There is also another species of zero which we may call a *discontinuous* zero. This zero occurs when an impossible equation has zero on one side of it. The characteristic of this zero is, that the other side of the impossible equation can make *no approximation* to it, provided we confine ourselves to possible (*i.e.* real or unreal) quantities. This property was pointed out by Professor J. R. Young, (vol. xlix., p. 463).

In concluding the *Horæ Algebraicæ*, I crave the indulgence of the reader for a few observations on the Algebra of Impossibles. Since writing the preceding paper of this series, some further remarks of mine "On a New Imaginary in Algebra" have appeared in the *Philosophical Magazine* (vol. xxxiv., pp. 37—47). In the course of those remarks (*Ib.* pp. 40—41), I have contended that the square of an impossible quantity, such as

$$\mp\sqrt{(\pm 1)^2},$$

may be possible. I consider that the effect of involution is to obliterate the radical sign; and I seize this opportunity of stating that the same view had been taken nearly three-and-thirty years before, by THOMAS WHITE, of Dumfries Mathematical Academy, in considering the value of the square of $\sqrt{-1}$. He says that the square of this quantity is to be obtained "by merely expunging the notational mark $\sqrt{\ }$." I strenuously recommend the perusal of his paper "On the Algebraical Expansion of Quantity," &c., to the attention of mathematicians. It appears in the Appendix to the *Ladies' Diary* for 1839 (pp. 59—70.) He dwells on the necessity for taking into consideration the *remainder*, when we obtain a series by division. It must be confessed, however, that, in seeking to determine $\sqrt{-1}$, he loses sight of that principle.

This being premised, I proceed to give a sketch of that Algebra which includes among its imaginaries the impossible quantity or symbol which I have previously represented by i, but which I now denote by β. And, in doing so, I shall avail myself of a nomenclature which (with the exception of the term *submodulous*) has been borrowed from the Quaternion Theory.

(1). The quantities α, β, γ are three Pure Imaginaries, or *imaginary units* defined by the equations

$$\alpha^2=-\beta^2=\gamma^2=-1$$

$$\alpha\beta=\gamma,\ \alpha\gamma=-\beta,\ \beta\gamma=\alpha.$$

(2.) Let w, x, y, z be any real quantities, positive, negative, or zero. Then I term these quantities the CONSTITUENTS of the expression

$$w+\alpha x+\beta y+\gamma z;$$

and this expression I denote by t, and call it a TESSARINE.

(3.) Suppose that

$$\mu^2=w^2+x^2+y^2+z^2,$$

and

$$\nu^2=wy+xz,$$

then I call μ the MODULUS and ν the SUBMODULUS of the tessarine t. Both the modulus and submodulus are to be regarded as positive.

(4.) Let

$$w=\mu\ \cos.\ \theta,$$

then I term θ the AMPLITUDE of the tessarine t. So, if

$$x=\mu\ \sin.\ \theta\ \cos.\ \phi,$$

ϕ is the CO-LATITUDE of t; and, if

$$y=\mu\ \sin.\ \theta\ \sin.\ \phi\ \cos.\ \psi,$$

then ψ is the LONGITUDE of the tessarine. To this may be added that, under the above suppositions, we have necessarily

$$z=\mu\ \sin.\ \theta\ \sin.\ \phi\ \sin.\ \psi.$$

(5.) Let w', x', y', z' be the constituents of another tessarine t', and suppose that

$$t\times t'=t'';$$

then t'' is a tessarine, and, if w'', x'', y'', z'' be its constituents, we have the following relations (*Phil. Mag.*, s. iii., vol. xxxiii., page 437.)

$$w''=ww'-xx'+yy'-zz',$$
$$x''=wx'+xw'+yz'+zy',$$
$$y''=wy'+yw'-xz'-zx',$$
$$z''=wz'+zw'+xy'+yx'.$$

(6.) In what follows, I gladly avail myself of a process due to Professor J. R. YOUNG, of Belfast, and given by him in his paper "On an Extension of a Theorem of Euler" &c., published in Part II. of vol. xxi. of the *Transactions of the Royal Irish Academy*. A little consideration will enable the reader to trace the law of formation of the expressions a, b, c, d.

$$\begin{array}{l} x'+w'+z'+y' \\ \underline{w+x+y+z} \\ wx'+xw'+yz'+zy',\text{ or } a; \\ ww'-xx'+yy'-zz',\text{ or } b; \\ wz'-yx'+zw'-xy',\text{ or } c; \\ wy'-zz'+xz'-yw',\text{ or } d; \end{array}$$

Let μ', μ'' be the respective moduli of t' and t''; ν' and ν'', respectively, being their submoduli. Then, since

$$\mu^2\mu'^2=a^2+b^2+c^2+d^2,$$
$$c=z''-2(yx'+xy'),$$
$$d=y''-2(yw'-xz'),$$
$$a=x'',\text{ and } b=w'',$$

we are in a condition to determine μ'' in terms of μ, μ', x, x', ., ., z, z'. In fact, availing ourselves of the relations

$$z''-yx'-xy'=wz'+zw',$$
$$y''-yw'+xz'=wy'-zx',$$

and of the circumstance that

$$(p-2q)^2=p^2-4q\,(p-q)$$

identically; we arrive at

$$\mu^2\mu'^2=\mu''^2-4\mathrm{R}$$

where

$$\begin{aligned}\mathrm{R}&=\left.\begin{array}{l}(xy'+yx')(wz'+zw')\\+(yw'-xz')(wy'-zx')\end{array}\right\}\\&=(wy+xz)(w'y'+x'z')\end{aligned}$$

after the proper reductions. Hence we see that

$$\mu''^2 = (\mu\mu')^2 - (2\nu\nu')^2.$$

I have confirmed this result by making the following arrangement;

$$z' + w' + y' + x'.$$
$$w + z + x + y.$$

In this case it will be found, on carrying out the processes, that we arrive at the same result, but by slightly different means, the value of R now being

$$\left.\begin{matrix}(xw' + yz')\,(wx' + zy') \\ -(xx' - yy')\,(ww' - zz')\end{matrix}\right\}$$

(7). In order to determine ν'' we must, by actual substitution, multiplication, &c., find the value of

$$w''y'' + x''z''$$

in terms of the constituents of t and t'. This being done, many of the terms will be found to cancel one another, and those which remain may be expressed thus:

$$\left.\begin{matrix}(w^2 + x^2 + y^2 + z^2)\,(w.x' + y'z') \\ +(w'^2 + x'^2 + y'^2 + z'^2)\,(wx + yz),\end{matrix}\right\}$$

and we have the relation

$$\nu^2 = (\mu\nu')^2 + (\nu\mu')^2.$$

(8). We see that when the submoduli of the factors vanish the submodulus of the product vanishes also. Further, if, in the equation

$$\nu = wy + xz = 0,$$

we give to w an arbitrary value and regard it as constant, that equation represents a hyperbolic paraboloid. And here I leave the theory of tessarines; a subject too abstruse to be further discussed in this work.

I have a remark to make on the subject of Prof. YOUNG'S paper at pp. 463-4 of the last (xlixth) volume. Supposing the equation 8 of p. 130 of his Algebra (4th edition) to be solved by the value $x=5$, when the radical is taken *positively*, then, since

$$5 - x = 0,$$

the given equation becomes on due reduction,

$$3\sqrt{0} = 2 \cdot 0,$$

a symbolic absurdity. I shall in a very fearly Number of this Journal make some further remarks upon the subject of this equation.

I would also observe that the method by which I have (*supra*, pp. 33-4) solved four simultaneous quadratics of the eighth order, is a combination of my Method of Vanishing Groups with Mr. JERRARD'S Method of Vanishing Coefficients and with the Method of Disposable Multipliers.

I should add that, in the last of these *Horæ*, I have omitted to name the volume of the *Scriptores Logarithmici* which I was citing. It is the *last* volume which I alluded to.

And, now, I must beg of the reader who has followed me through this series of papers to look with an indulgent eye on such defects as may have occurred to him during their perusal. I hope, on some future occasion, to return to the subject uppermost in my mind when I commenced these *Horæ*. That subject was, the possibility of determining (from the analytical conditions and *à priori*) what results afford, and what do not afford, valid solutions of a given problem. It was the prosecution of this inquiry which led me to that of the Theory of Surd Equations. And, if I have suffered this Theory to divert me from my original aim, perhaps its interest and importance may be a sufficient excuse. At the same time it must be remembered that, in IX. of these *Horæ*, we have employed the principle, used in the first of them, to discriminate *à priori* which of the two congeneric surd equations admits of solution.

2, Church-yard Court, Temple,
January 22, 1849.

Corrections.—P. 34, col. 1, line 4 from the bottom, *omit* "D=0" and "D'=0." Line 2 from the bottom, *for* "four" *read* two. Last line. *Add*

$$Ax^2+Fy^2+Gy+H=0,$$
$$A'x^2+F'y^2+G'y+H'=0,$$

be the result of this elimination. And let G and G' be made to vanish, and also

P. 34, col. 2, first line, *for* "B" *read* F, and *for* "B'" *read* F'.

THE CASE OF THE WORKING BAKERS.

Sir,—The condition of the working baker has long engaged my anxious attention. Like medical men, they watch while others sleep. Like medical men, too, they are condemned to breathe an impure and poisonous air.

The baker in preparing the staff of life for others, is slowly, but surely, sapping the foundations of his own. He is subjected to a fiery atmosphere, and respires the various matters, that is to say, carbonic acid, watery and spirituous vapours, emitted by the heated loaves. Bakers, in consequence, are everywhere, even in early life, a haggard, wasted race,

rarely reaching advanced life. Such a thing as an aged journeyman baker is nowhere to be seen.

The remedy for this state of things is to have *ventilating* ovens. The bakers would become healthier; the bread, no longer sweltering during the baking process in a foul and pernicious medium, would become far sweeter and better tasted; while a very valuable product, alcohol, now lost, would be secured in quantities more than sufficient to supply all the arts in which it is required.

A worm proceeding from every oven, passing through cold water, would condense the alcohol; an escape-pipe would yield issue to the gases.

As bearing on this important subject, I may advert to M. Violette's paper in the *Journal Chim. et Phys.*, on the carbonization of wood by means of heated steam. M. Violette's discovery has many important economical bearings, but what chiefly interests me in it, is its singular applicability to the baking of bread. Steam, at a temperature of 480° Fahr., is let on; this escapes, carrying with it all vaporizable substances; and the result is, (to use the language of the able editor of the *Pharmaceutical Journal*, in his last December number) "in a very moderate time, and with perfect success, bread (loaves and biscuits to wit) particularly sweet and well tasted, and the exposed parts covered with a golden crust very agreeable to the eye."—I am, Sir,

HENRY M'CORMAC, M.D.

Belfast, January 26, 1849.

FULLER'S REVOLVING LOGARITHMIC SCALE.

Seven years ago (No. 949) a learned and much-esteemed correspondent described a brass circular sliding rule, made at Paris, of 4½ inches diameter. This scale was said to be as well divided as an astronomical instrument—a position which our correspondent did not find any means of disputing. But he said, he would rather use a small table of logarithms, than bring out all the power of this brass rule. "And," he added, "I believe that as soon as the sliding rule ceases to be an instrument for rapid inspection, the small table of logarithms would take less time." Mr. Fuller, of Boston,* (U.S.) has come over to this country with an instrument for sale, to which our correspondent's objection does not apply. It is a circular sliding rule on a larger scale, eight inches in diameter; it therefore answers to a wooden rule of 25 inches long in scale. The material is nothing but pasteboard, in which is a circular excavation, into which is let a circular pasteboard plate which just fills it. The fixed pasteboard and the revolving one have each a logarithmic scale pasted on; so that by the revolution of the plate, any division of the inner and outer scale may be made to coincide. Our engineering friends will perhaps smile at this *paper currency*; but we recommend them to examine Mr. Fuller's divisions before they settle in their own minds of what it is capable. The work is beautiful; and the scale is really an effective one of its size. When both scales are made to coincide throughout, there is no appearance of warping or of bad pasting anywhere, and the consonance of the divisions, in all cases, furnishes a strong illustration of the truth of Euclid's remark, that a straight line may be produced in a straight line.

A similar scale on the other side of the pasteboard basis, having an independent plate turning on the same axis as the logarithmic one, has a rule for passing from one day of the month to another by the number of days, &c.

The paper scale has one great advantage over the wooden one. Readings may be printed upon it to an extent which would be impracticable upon the wood. This is the case in Mr. Fuller's instrument, and the consequence is that the second and third figures of the result come off with very great ease.

Many commercial gauge points are inserted; indeed, Mr. Fuller's object seems to be the attraction of commercial patronage. We heartily wish him success. The commercial calculator neglects the sliding rule. To be sure, our subdivision of the pound is against it, and a great many calculators of shillings, pence, and farthings are not aware that the reduction of the silver and copper to decimals of a pound can be done in the head, after half an hour's practice. Mr. Fuller states that he has had a

* Now of 162, Regent-street.

large sale in America, where the division of the dollar is decimal. The end of it will be, that our United States brethren will establish logarithmic calculation in commercial matters. We might do the same either by a decimal coinage, or by the very easy rule which turns our secondary coins into decimals of a pound. Without at all implying that Mr. Fuller's apparatus is only to be recommended for commercial purposes, we feel inclined to press it upon men of business, as those who might be most benefited by a handy implement, which might hang against the wall of the counting-house, and would not only give something more than a rough answer to very extensive classes of questions on demand, but would check the leading figures of elaborate computations.

GRIST'S PATENT REVOLVING FURNACE.

[Patent dated July 29, 1848. Specification enrolled Jan. 29, 1849.]

Fig. 4.

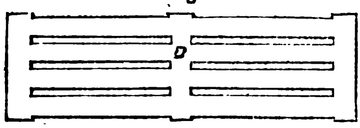


Fig. 5.

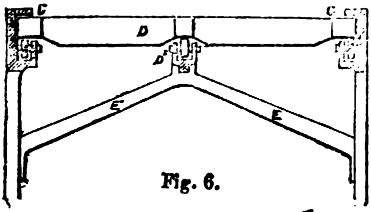


Fig. 6.

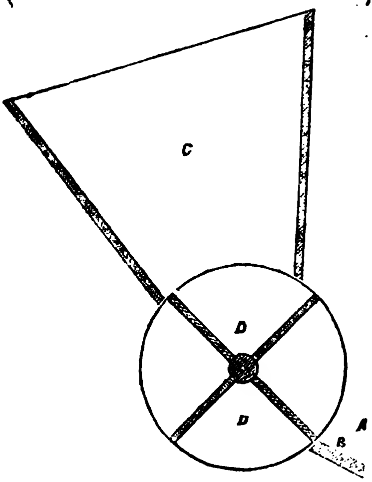
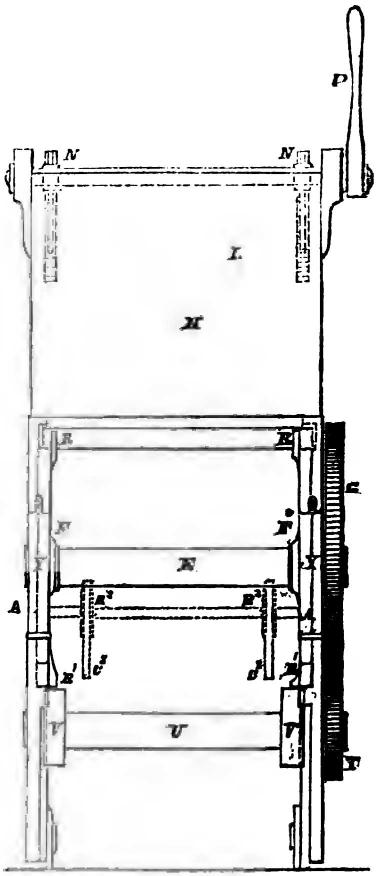


Fig. 3.



Mr. Grist's revolving furnace is the best of its class that we have yet seen. It is wholly free, from two of the greatest practical objections usually urged against furnaces on this plan, namely, the interference with the draught, and difficulty of getting at the fire-bars for the purpose of replacement or repair. The atmospheric air has a free passage from the front to the back of the furnace; the fire-bars are loose, and used either singly or in series of not more than three or

four; and when one of the bars, or one of the series of bars, gets worn or damaged, all that is necessary is to drop a side flap, take it out, and put in another. Again; the same mechanical movement which causes the hopper to throw a fresh feed of coal into the furnace, pushes simultaneously forward into the heart of the furnace, the last preceding supply, which by this time has become thoroughly coked. The feed is thus always kept in an exact ratio with the consumption; smoke is prevented; and the greatest heating effect possible, obtained from any given quantity of fuel.

We extract the following description from the patentee's specification:

Fig. 2.

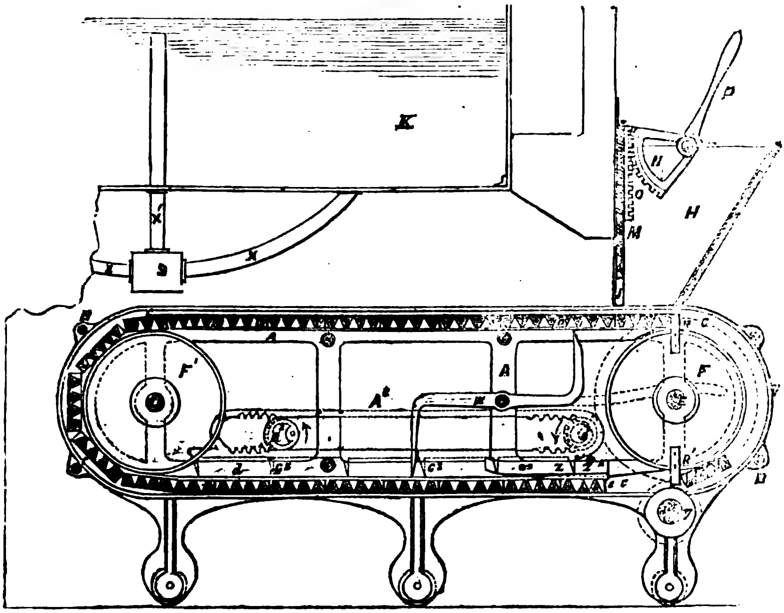


Fig. 1.

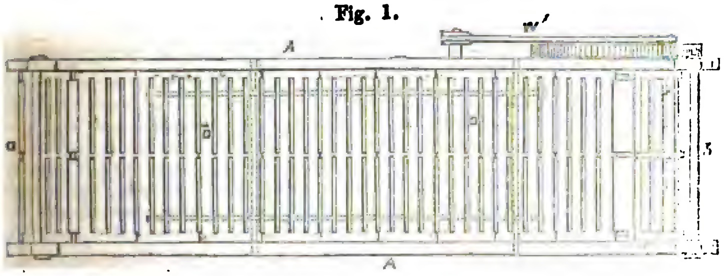


Figure 1 is a top plan of a furnace embodying my improvements with the boiler removed. Figure 2 is a longitudinal section on the line *ab* of fig. 1, and fig. 3 is a front elevation. A A, are two side frames connected together by transverse stay-bolts, B, B, B. C C, are continuous grooves, or channels, formed on the inner faces of these side frames, A A. D D, fire-bars, which rest and move forwards and backwards in the grooves, C C, when acted upon as hereinafter explained. E and E[1], two spindles or shafts which fit concentrically into the semicircular ends of the grooves, CC, at the front and back ends of the furnace. Each of these shafts again carries two discs or wheels, F[1], F[1], the peripheries of which coincide with, and

form in effect the inner sides of the grooves, C C. G, is a toothed wheel which is keyed to the same shaft, E, as the discs, F F, so that when the wheel is made to rotate it carries the discs, F F, along with it. H, is the hopper, which has a moveable front, L. J, is the opening from the hopper to the interior of the furnace. M, the fire door. P, the handle. N and O, toothed segments and racks, by which the door is raised and lowered, and K, the boiler. The atmospheric air, it will be seen, has a free and unimpeded passage into the heart of the furnace. The fire bars instead of being cast singly are cast in sets of fours; as separately represented on an enlarged scale in fig. 4, which is a top plan, and in fig. 5 an edge or side view of a single bar, or set of bars. The object of having the bars cast in sets is to produce greater steadiness of motion in passing along the grooves, and to prevent their getting into an angular position, and falling out of the grooves.

The mode of working this furnace is as follows: The moveable front, L, of the hopper is taken out, and the fire door, M, lifted up by means of toothed segments, F, and racks, O. The attendant has then access to the furnace to kindle the fire, after which he adjusts the door to the proper height to give the requisite feed of coal to the furnace. The front of the hopper being replaced, it is filled with fuel. Motion is then communicated to the wheel, G, by hand, which causes the whole of the uppermost set of fire bars (which only are for the moment covered with fuel) to advance gradually from the front of the furnace towards the back end of it. The fire bars so pushed forwards, press against the bars resting upon the discs, $F^1 F^1$, and in the lower groove, CC, and thereby cause them to advance from the back towards the front of the furnace; that is to say, the teeth, R R, or $R^1 R^1$, affixed to the discs, F F (one or other of them pressing upon the bar next in the series), cause a simultaneous progression of the furnace bars from front to back, and from back to front.

The movement just described causes, in the first instance, the bars which were under the hopper to carry into the mouth of the furnace a certain quantity of coal where it is coked, while at the same time the whole of the fire resting upon the upper surface of the fire bars at top, is made to pass a short distance towards the back of the furnace. The moment the teeth, R R, have thus pushed the bars as far forward as will allow of their passing clear, then the bars, fire, &c., remain unaltered by the rotation of the discs, F F, until the single set of four bars, D^1, which are in advance of the teeth, $R^1 R^1$, are by the rotation of the discs, F F, brought up so as to press against the last bar which was acted upon by the teeth, R R, when another portion of fresh coal is introduced into the furnace, and that which had just previously been supplied, having had time to become coked, is carried further into the furnace. And so the action goes on as long as motion is communicated to the wheel, G, and fuel supplied to the hopper. The rate of feed is of course regulated by the height to which the door, M, is raised up from the surface of the fire bars, and the degree of velocity given to the wheel, G. Motion may be given to the wheel, G, either by hand or by means of wheel gearing driven by any prime mover. To work this furnace to the greatest advantage, the opening for the supply of fuel, and the motion of the bars, should be so adjusted in respect of each other, that the whole of the supply of coal or fuel should be nearly burnt off the bars before passing under the bridge, S, of the furnace. T, is a pinion which gears into the wheel, G, and is fixed upon the end of a shaft, U, which carries two pulleys, V V. The office of these pulleys is to cause the last of the bars in the lower groove, C, to be carried sufficiently far forward to be laid hold of by the teeth, R R, or $R^1 R^1$, and so to prevent the bars resting in such a position as to get interlocked between the teeth. As in stirring up the fire, by means of irons introduced through the furnace door, the bars would be liable (if not secured in the meanwhile) to get pushed out of their places, this is prevented by means of a bent lever, W, which is acted upon by a handle, W^1, so that when that handle is raised up, the opposite ends of the lever, W, take into the furnace bars, and prevent their moving, for the time being, either forwards or backwards.

In the event of any of the bars becoming wasted or broken, they can easily be taken out and replaced, even while the furnace is in action, by opening a portion, Y, of the front side of the groove, C C; this part of the ledge of the groove being hinged, so that it readily admits of being opened for this purpose. Z, is one of a pair of levers which are affixed one to each side frame by the pin, z, upon which they are free to turn as on an axis. These levers produce a dragging effect upon the bars, D D, on which they rest, and so prevent them from being pushed forward by the weight of those bars, which are in the semicircular portion of the groove, C C, at the back end of the furnace. The levers, Z, are pressed down by a weight, Z^2, which lies across the ends of both levers.

When furnaces of this description are constructed of larger dimensions, or when

the furnace bars are likely to be subjected to a very high degree of temperature, then, in order to reduce the friction produced by the rubbing of the fire bars in travelling along the grooves, CC, I introduce a set of friction wheels, AA, which are mounted as represented in fig. 5, in proper bearings formed in the lower sides of the continuous groove, and placed at about distances of nine or ten inches apart. The distance between the one friction wheel and the other, is made always less than the breadth of one of the combined sets of bars, so that the bars may at no time be left entirely resting upon the lip or side of the groove. By this arrangement the movement of the bars is greatly facilitated, and less power required to work the furnace. Again—to prevent the bars from falling down or bending under the weight of the fuel when they become heated, I pass a beam or bar, D^3 (or two or more such bars), nearly the whole length of the furnace, under the fire bars. The upper edge of this beam is also provided with friction wheels, and the fire bars themselves have a central rib, by which they may rest and run upon the friction wheels. The central bar, D^3, is supported by angular struts, EE, from the side frames of the furnace.

Mr. Grist's furnace includes a very ingenious arrangement, by which a most valuable addition is made to the water spaces of the boiler:—

Sometimes, instead of having the bridge of this furnace solid, I make it hollow, and of the same sort of materials as the boiler itself, and connect it to the boiler by means of sets of pipes, X and X^1, as represented in fig. 2, one set of which are continued some distance up inside the boiler, and serve to carry off the steam generated in the bridge.

Two alternative modes—one for regulating the feed, and the other for giving progression to the fire bars—are also described.

Mr. Grist's patent comprehends also what appears to be a very valuable improvement in the fire-boxes of locomotive engines. The fire bars are made hollow, *inclined at an angle from the horizontal line* and communicate at the ends with the boiler:—

By thus having the hollow fire bars placed inclining at an angle to the horizontal line, as represented, a free circulation of water is kept up within them, and there is no danger of the water being entirely driven out of them by the generation of steam, as almost always occurs in the case of horizontal water fire bars.

An improvement in ovens (distinct from the others) is also described. It consists simply in adding two side flues for the introduction of fresh air into the back of the fire-place, as required.

Claims.

First. I claim the improved arrangement of means for adjusting with exactness the feed to the consumption of fuel in furnaces, and for giving a progressive movement to the fuel while in the course of being consumed, embodied in the furnace first before described, that is to say, in so far as regards the wheel, G, and the parts connected therewith, whereby they regulate simultaneously the delivery of fuel from the hopper and the progression of the fire bars, without impeding the free course of the atmospheric air into the heart of the furnace; and in so far also as regards the employment of loose fire bars, running singly or in sets of three or four, in grooves; the hinged side flap for withdrawing and replacing the bars when worn out; and the application thereto of an under supporting bar, or bars, and friction wheels.

Second. I claim the employment in boiler furnaces of hollow bridges when connected by two sets of pipes with the water spaces in the boiler, as described. And the formation of the furnace discs, F^1F^1, into a drum communicating with the boiler and feed pump, as described.

Third. I claim the alternative mode of regulating the delivery of fuel from the hopper represented in fig. 6.

Fourth. I claim the alternative mode of giving progressive motion to the fire bars indicated figs. 1, 2, and 3.

Fifth. I claim the employment in the furnaces of locomotive engines of hollow fire bars, inclined at an angle from the horizontal line, and communicating freely at their ends with the water spaces in the boiler. And,

Sixth. I claim the improved oven furnace before described, in so far as regards the side air flues, DD.

GLASS PIPES.

Sir,—Having observed in your Journal of November a letter from a Mr. Henry Malcolm, stating that he had successfully laid down and jointed 900 feet of *glass pipes* for the Earl of Zetland, of Upleatham Hall, Yorkshire, it does appear strange that the Officers of the Woods and Forests, after the late cases of poisoning at Claremont, should have again employed metal pipes of an expensive character, and probably subject to the same influences, rather than employ as a medium one of the cleanest and purest vehicles for the con-

veyance of water ever yet introduced, and that, too, for one of the royal residences. Has any reason been given, or can any be assigned for this (apparently) very stupid and culpable indifference to improvement?

I am, Sir, yours, &c., A SUBSCRIBER.

January 27, 1849.

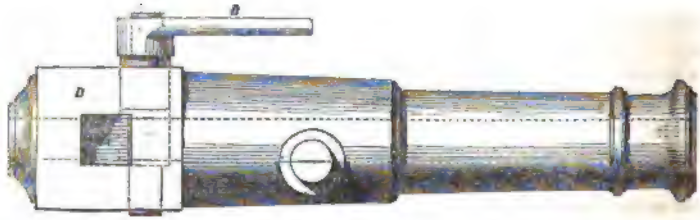
[It does seem strange that glass pipes should not have been adopted; but *possibly* there may be a question of pressure involved in the Claremont case which would explain all. Iron and lead pipes will resist a pressure which glass will not.—ED. M. M.]

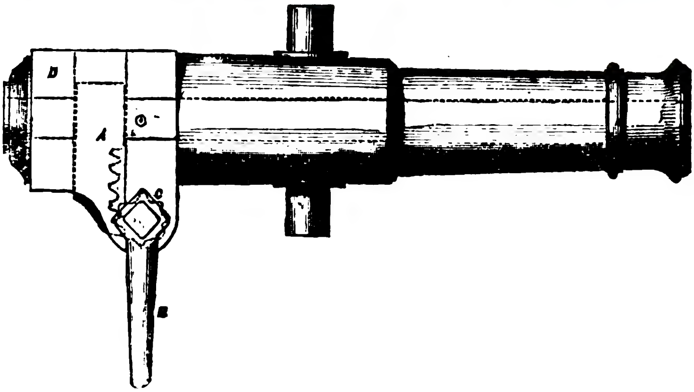
GAS METERS—ANOTHER MOVEMENT.

A petition to the House of Commons is getting up at Birmingham, praying that the House "will enact such laws as will ensure that all gas meters *shall be properly proved and inspected*, either by bringing them under the same regulations and restrictions as *measures generally*, or in such other manner as may appear most conducive to the desired end." And Mr. Scholefield, it is stated, "intends introducing a bill during the session to remedy the alleged evil."

We should like to know who the active promoter of this movement is, as then we should no doubt have a vision of an Inspector General of Gas Meters *in petto*, and be able to appreciate more correctly than we can do at present what the "desired end" really is. Not, surely, our old friend, Mr. Flower? We must confess that we entertain the strongest possible doubts of any portion of public good being included in the "desired end." We can readily understand how such an inspectorship might, and, in all likelihood, would be converted into an instrument of enormous jobbing and mischief; but how consumers could gain anything by it we are at a loss to perceive. It is a great mistake—though in Bœotian districts, we believe, rather a popular one—to suppose that the gas meter is a wicked invention of the companies for victimizing the public. The companies opposed its introduction to the utmost; and if they had had their own way, such a thing as a gas meter would not now to be met with. The actual state of the case cannot, perhaps, be better expressed than in the following brief extract from a letter, written several years ago to a Sheffield paper (on a movement, if we recollect rightly, very similar to the present), by the late lamented Samuel Crosley, the father of the gas-meter trade (saving always, of course, the rights of Mr. Clegg, who invented the meter which Mr. Crosley became the proprietor of, and was the means of introducing into universal use):—"*A meter never robs the consumer; it never goes without gas to turn it; it may, if imperfect, stand still, and let the gas pass unregistered; and so* ROB THE COMPANY" (not the public.)

IMPROVEMENT IN ORDNANCE. BY JOSEPH MAUDSLAY, ESQ.





The above engravings represent an improved construction of cannon, which has been just offered for the consideration of Government by Mr. Maudslay. Plans for loading and sponging cannon from the breech have been before proposed; and the advantages of being able to do so are admitted on all hands—embracing, as they do, greater rapidity in firing, a considerable reduction in the number of hands required for the working of each gun, and much less exposure to the ene-

my's shot; but never, to the best of our recollection, have means been devised for the purpose, at once so simple and (to all appearance) so perfectly efficient. The gun is bored right through from end to end; a square aperture is pierced through the breech, D, and at right angles with the bore; and a bolt, A, which fits this aperture exactly, is passed through or withdrawn from it (the affair of an instant) by means of a rack and pinion, C, and handle, B. When the gun is to be loaded or sponged, the bolt is withdrawn, and when the bolt is returned into its place, the breech will (it is supposed) be restored to as efficient a state, for all practical purposes, as if it were formed of one entire solid piece.

MR. W. H. SMITH'S YIELDING BARRIERS. FOR HARBOURS OF REFUGE.*

The extensive discussion which the cognate subjects of Refuge Harbours and Sea Walls has recently undergone in this and other Journals, has induced the author of the present pamphlet, to recall the attention of the public to an Elastic Mooring for Breakwaters, which he patented a few years ago, the principle of which, he thinks equally applicable to marine barriers of every dedescription,—floating docks only excepted. Mr. Smith shares in the "gloomy forebodings" which the determination of Government to "build an upwright wall of masonry at Dover, to break off the force of the sea," has created in the minds of "some of our first engineers"—anticipates for it as signal a failure as has (in his judgment) attended the sloping breakwater system—pronounces all the plans which have been hitherto proposed for resisting the power of the waves, as alike ineffective—and thus introduces his own scheme to the notice of the reader:—

The plan here brought forward is perfectly original, and differs essentially both in principle and operation from all piers or sea-walls hitherto advocated. Instead of withstanding the shock of the sea, it at once eludes its power, and this from the example of Nature herself, which is ever the safest handbook to practical science. Smeaton, in the first marine work of the kind that has ever succeeded, closely copied nature. He took for his model the trunk of the majestic oak, with its spreading base and gradually tapering stem, and he triumphed. The discoverer of this system has a parallel precisely analogous, and of equal or more force. The pliancy of the branches of some of the weakest trees, the willow for instance, enables them to spring before the most violent blast, and return to their place in the lull of the storm; whilst the more stubborn, as the oak in the fable, from their unyielding nature are destroyed—the very fate as well as character of our present harbours.

This yielding principle is adopted in the proposed plan, and is found to be of even more value to sea structures; the waves being intermittent, and thus striking and recoiling more regularly than the blasts of the gale. Since the days of Dibdin it has passed into a proverb, that a tight ship and good sea room imply perfect safety, or, in other words, that the sea has no power of injuring a vessel so long as she can yield to its shock; thus a ship, an empty cask, or the most fragile body, may drift at sea in a gale with safety. Such is peculiarly the principle of this invention. It yields freely in the first instance to each wave as it is swept forward, gradually increasing its resistance, until at length the momentum of the latter is absorbed, it becomes reduced and disseminated, and the yielding framework recoils to meet by a similar operation each successive wave.

Mr. Smith's yielding bulwark may be thus briefly described:—It consists of a hollow framework of timber (a floating breakwater, in fact, with gangway at top), which is secured to the ground by screw piles (Mitchell's patent), but *is free to oscillate on these piles*, within certain limits, determined by mooring blocks and counterbalance weights, thrown out to seaward.

Mr. Smith states that this "extended applicability" of his Elastic Mooring to the construction of piers, harbours, &c., has "only been discovered within the last few months." If he will refer to an able paper by Lieut.-Col. Yule, R. E., in our last volume, and also to a communication from another distinguished officer of the same branch of our military service, in vol. xlvi., p. 216, he will see that the idea of a yielding marine barrier is not so "perfectly original" nor so "essentially different, both in prin-

* Harbours of Refuge on a Principle applicable to all Marine Structures. By William Henry Smith, C. E. 31 pp., 8vo. With Frontispiece. Longmans and Co.

ciple and operation, from all piers or sea walls hitherto advocated," as he imagines. However—this exception on the score of novelty notwithstanding—we must say, we think well of his plan, and trust that he will, ere long, be afforded an opportunity of practically testing its value.

VENTILATION OF STEAM SHIPS.

Sir,—I am much pleased with Dr. M'Sweeny's plan for the ventilation of ships, given in your 1324th Number. It is well adapted for sailing vessels, but would, in my opinion, be entirely out of place in steam ships, where the draught from the chimney offers a readier and much more effectual means of attaining that end. All that is necessary to be done in them, is to open a passage for ai from the cabins, sleeping berths, hold, and other parts of the vessel requiring ventilation, to the furnace room, and the ventilation will at once proceed in the most satisfactory manner. By means of doors or dampers in the air passages, its intensity may be modified to any degree required.

I do not think there would be any necessity for closing the skylight of the engine-room, through which at present the furnace draws its supply of air; for that air, becoming warmed in its descent through the engine room, must give way to the colder and denser air of the other parts of the ship. Hence, also, this plan, besides ventilating the ship, will have the further advantage of procuring a freer supply of air for the furnace—an object of some consequence in certain changes of the wind.

I am, Sir, yours, &c.,

ROBERT AYTOUN.

Edinburgh, Jan. 29, 1849.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED BETWEEN FRIDAY, JAN. 26, AND FRIDAY, FEB. 2.

WILLIAM THOMAS, Cheapside, merchant. *For improvements in the manufacture of stays, boots, and shoes; also in fastening and connecting fabrics and garments.* Patent dated July 26, 1848.

These improvements refer, 1. To the ornamenting of stay fabrics. 2. To taking up the work in weaving the gores of stay fabrics. 3. To arrangements of apparatus for forming the gores and plain parts. 4. To a mode of sewing stays or connecting parts of garments, wherein the needles used are made to pass through and through, and the thread drawn by another apparatus. 5. To an arrangement of apparatus for forming the stitch in tambour work. 6. To a mode of sewing when the shuttle is used, in combination with a hooked apparatus to introduce a second thread. 7. To the manufacture of boots. 8. To a mode of connecting trousers or gaiters to boots and shoes.

1. The "ornamenting of stay fabrics" is caused by the introduction of extra threads into the shed during the process of weaving. This is effected by means of a bar, supported in front of the reed, on the ends of two levers attached to either side of the loom, to which a rising and falling motion is communicated through the intervention of suitable gearing from treddles or cams. To this bar is attached another, on which are mounted the thread carriers. These carriers have a tendency to move towards the left-hand end of the loom, while their direction to the right-hand is controlled by lace or other wheels, having the patterns indented on their peripheries, which act upon the extremities of the carriers. From the carriers descend guides, which conduct the threads into, between, and near the bottom of the shed. The shuttle is then thrown, and when the guides are withdrawn by the rising of the bar, and the beat up by the reed has taken place, these extra threads will be tied up in the fabric.

2. The "taking up of the work" is effected by a cylinder placed in front of the loom, having notches in its periphery which contain ratchet catches capable of retaining a bar in the position in which it may have been pressed by hand levers. This bar is bent, and the ends project downwards upon the selvages, so that they, and not the centre of the fabric, may be acted upon when the bar is depressed.

3. The weft of which the gores are formed is introduced between the shed by the following improved arrangement of apparatus. On each side of the loom is a horizontal bar, sliding in grooves, which guides the weft into the shed. To the outer ends of these guide-bars are attached levers, which are acted upon by lace or other pattern wheels, whereby the distance which the two wefts are carried into the shed is progressively increased until it has reached its maximum, when it is gradually decreased to finish the gores. As the guide-bars slide in and out of the same place, the weft is retained in its proper place by means of a row of pins, which are held in vulcanized India-rubber collars, fixed on a cross bar. Above the pins slide bars (with the ends curved upwards), which per-

take of the to-and-fro motion of the guide-bars, and whose office is to depress a number of pins equal to the depth the guide-bars enter the shed; the harness is then changed, and the weft held between the shed. The bars are withdrawn, and the pins lifted up into their original position, by means of another punctured bar, which is placed between the heads of the pins and the first bar, and which is made to rise up when the guide-bars are drawn out by suitable gearing. The weaving operation is then completed in the ordinary way. When the plain parts of the fabric are to be woven, one of the guide-bars is made to pass through the shed to the opposite selvage, where the thread which it carries is held by the pins.

The patentee next describes a modification of the preceding arrangement, in which the weft is made to travel in the shed on a spindle. But in consequence of the drawings in which it is represented having been lettered as belonging to the fifth, instead of the third portion of the invention, there is a degree of confusion in this part of the specification which we must be excused from attempting to unravel.

[The whole of this specification, indeed, has been got up in so careless a way, as to make no part of it so easy of comprehension as it should be. Several of the drawings are overrun with neglected pencillings, which render it a task of some difficulty to pick out the true lines from those intended to be rubbed out. All this is the more objectionable, that the machinery described is of a sort which requires, more than any other, the nicest accuracy in representation and description.]

4. The fabric to be sewn is caused to pass, by a step-and-step movement, over a slotted table, above and below which are nippers, each consisting of a fixed and moveable jaw. Each nipper is attached to one end of an oscillating lever, acted upon at the free end by suitable gearing, so that the nippers are caused to approach to and recede from the table. The nippers are, moreover, so constructed as that they shall alternately open as they approach and close as they recede from the fabric. The needle, having the eye in the centre, through which the thread passes, is held between the moveable and fixed jaws of (say) the top nipper. It is then caused to approach the table and to pierce the fabric, when it is laid hold of between the fixed and moveable jaws of the lower nipper, and drawn through it. The needle is subsequently passed through the fabric again up to the top nipper, and is caused to pass backwards slightly, so as to leave sufficient thread for the next stitch. The thread is caught by a hooked apparatus (to which a to-and-fro movement is communicated simultaneously with the other parts of the machine), whereby it is drawn tightly through the fabric.

5. The stitch in tambour-work is formed by a needle, carrying the thread, which is caused to take in and out of the fabric by means of toothed gearing and cams fixed on the periphery of a cylinder, which acts upon a stop fastened on the plate supporting the bar which carries the needle. When the thread has been carried through to one side of the fabric, it is there caught hold of by a peculiarly constructed hooked apparatus (which is made to travel backwards and forwards by a spring and suitable gearing), and the loop formed. The loop is maintained in its position while the needle is drawn back, and again thrust through the fabric, and the loop also. The hook then travels forward to take up the thread, and in returning forms the loop, when the operation is repeated. The length of the stitch is regulated by the distance the rack frame, carrying the fabric, is made to advance (by a cam keyed on the main shaft, acting upon a driver) at each operation.

6. Another mode of sewing, stated to be peculiarly applicable to stitch leather and stays, consists in causing the needle to draw the thread through the material so as to form a loop. The shuttle which carries the second thread is then driven through the loop, and the thread drawn tightly back by a spring apparatus.

7. The improvement in the manufacture of boots consists in making the upper part, which fits round the ancle, of rings of any elastic material stitched spirally together.

8. The improved mode of connecting trousers and gaiters with boots or shoes, is effected by means of a bow spring, which is passed through the hem of the trousers or gaiters, and which clings to the waist part of the boot or shoe. The bow springs may be furnished with projecting pieces at the ends to pass underneath the sole of the boot or shoe.

Claims.—1. The mode of ornamenting stay fabrics by the introduction of pattern or extra threads into the shed during the process of weaving.

2. The arrangement of apparatus for taking up the work in weaving the gores of stay fabrics.

3. The arrangement and combination of apparatus for forming the gores and weaving the plain parts of stay fabrics.

4. The apparatus for sewing stays or connecting parts of garments, wherein the needles used are made to pass through and through, and the thread drawn by a secondary apparatus.

5. The arrangement of apparatus for forming the stitch in tambour work.

6. The apparatus for sewing, wherein the shuttle is used, in combination with the needle, to introduce a second thread.

7. The mode of manufacturing boots and shoes.

8. The method of connecting trousers or gaiters to boots and shoes.

CHARLES HANCOCK, of Brompton, gentleman. *For improvements in apparatus and machinery for giving shape and configuration to plastic substances.* July 29, 1848.

Mr. Hancock claims, *first*, an "Apparatus for moulding hollow wares, in so far as regards base chuck and the shifting moulds or pattern pieces connected therewith."

The base chuck referred to is square, and has four dovetailed grooves cut lengthwise in its four faces for the reception of four pattern pieces, which are flat on their under faces, and have fillets by which they slide into the dovetailed grooves. All that is necessary when a change of pattern or design is desired, is to withdraw one set of moulds (from the chuck) and substitute another.

Second. Another "apparatus for moulding hollow wares," in which facilities are afforded for applying either hot or cold water, or steam, to the moulds, but "whether used with or without the parts thereof relating to heating and cooling."

Third. "An apparatus for preparing plastic materials (for moulding) in so far as regards the construction of a vertical presser with a horizontal bed, filled with hot water or steam, whether such table is fixed or moveable."

Fourth. An apparatus for "moulding plastic substances into continuous lengths, with supporting cores of wire, cord, or other like tenacious substances" and several modifications thereof, "in so far as regards the combination of a die-box, and a cylinder with piston, each working or operating in directions at right angles to, or more or less tangential to the other."

Fifth. A modification of the preceding apparatus, which consists in adapting it to "the production of short lengths of plastic materials of any required form (as mouldings, cornices, beadings, &c.,) with interior supporting cores."

Sixth. An "Improved apparatus for forming plastic substances into balls, in so far as regards its application to other substances than metals."

JOHN GRIST, of New North-road, Middlesex. *For improvements in furnaces and fire-places.* Patent dated July 29, 1848.

For specification and claims, see *ante*, p. 108.

GEORGE WALTER PRATT, Rochester, New York, gentleman. *For improvements in the manufacture of printing ink.* Patent dated July 29, 1848.

The patentee remarks that printing ink has hitherto been manufactured of a combination of linseed oil, rosin, colouring matters, and soap, that it is rendered "by reason of the use of linseed oil *expensive*," and that his invention has for its object to cheapen it by the substitution of rosin oil.

The mode of manufacturing the printing ink is as follows:—One pound of rosin oil, thirteen ounces of rosin, and five ounces of yellow soap are heated and well mixed together. The mixture is then allowed to cool, and is ground up with any suitable colouring matter, after which it is ready for use. The proportion of rosin is to be increased or decreased according to the degree of consistency desired to be given to the ink.

Claim. — The mode of manufacturing printing ink by employing rosin oil combined with colouring matters suitable for printing ink.

JOHN KING, foreman to Messrs. Shears and Sons, Bankside, and HENRY MEDHURST, operative engineer to the said Messrs. Shears and Sons. *For improvements in gas meters.* Patent dated July 26, 1848.

These improvements refer, *firstly*, to an arrangement of apparatus which acts and is acted upon by the diaphragm or moveable partition of the meter, whereby the flexible part of the diaphragm is caused to act the first, and the inflexible part is held back. And, *secondly*, to an instrument for communicating motion to the registering train of wheels. The lower part of the meter is divided into two compartments by the diaphragm, the inflexible part of which is fixed to an axle, supported at bottom in a suitable bearing, while the top passes through a stuffing-box into the upper chamber of the meter which contains the registering apparatus. The top of the axle carries a cross-bar, one end of which is embraced by the forked end of a weighted lever, suspended on an axle fixed to the back of the meter, which offers resistance to the movement of the inflexible part of the diaphragm until the flexible part has acted, whereby a better and more regular supply of gas is obtained. To the other end of the cross-bar is attached a plate, by means of an adjusting screw, which is suitably connected to a bar sliding to and fro in grooves, and furnished with a slot in the centre, in which works the stem of a weighted lever; so that when the sliding-bar shall have pushed it slightly beyond the centre, its own weight will cause it to fall on the other side, and thereby effect

the changing of the valves. Each compartment is furnished with inlet and outlet valves attached together by a bar, which is made fast to an axle. These axles pass through stuffing-boxes in the valve chambers to where the apparatus before described is contained, and are connected by a bent bar, having a slot in the centre, in which the stem of the weighted lever works; so that, as it is made to fall on the one side or the other, by the to-and-fro movement of the sliding-bar, it will press alternately against either extremity of the slot, thereby causing the axes which carry the connecting-bars of the valves to make a portion of a revolution, and consequently the different valves to open or close as the case may be.

The end of the sliding-bar acts upon a driver, which works into a toothed wheel fitted with a pinion on its axle, gearing into another toothed wheel, which communicates motion to a cylinder having a worm upon its periphery whereby the train of wheels, for indicating the passage of gas, is actuated.

The second part of this invention consists, in substituting for the worm on the cylinder, peculiarly shaped projections fitted to the axle, and gearing into a toothed wheel (which actuates the train of wheels), so that in whatever direction the axle may rotate, the toothed wheel shall revolve in one direction only.

Claims.—1. The combination of apparatus as described.

2. The combination of the parts (the projections, the axle, and the toothed wheels,) as described.

[Another specimen this of injurious haste —if not culpable negligence. The patentees state that their improvements are founded upon the invention which is "described in the specification of ————," and one of the sheets of drawings still bears the patentees' private instructions, in pencil, to the draughtsman to insert *x* here, *u* there, &c.]

JAMES TAYLOR, Furnival's Inn, gentleman. *For improvements in propelling ships and other vessels.* Patent dated December 2, 1848.

The improvements sought to be secured under this patent refer; 1. To a peculiar mould of a vessel; 2. To a propelling wheel for this kind of vessel; and, 3. To a mode of adapting this propelling wheel to vessels of the above construction. The mould of the vessel is of such a nature as that the midship section presents the appearance of an ellipse having the longest axis horizontal, which decreases (the perpendicular axis remaining the same) as the vessel approaches towards the stem and stern, until they are both equal, or the mould is circular; after which the horizontal axis decreases (the perpendicular one remaining the same) until the mould presents the appearance, at both ends, of the ellipse reversed, and finally merges into a wedge form. The keel is built on to the bottom, of such a depth as may be required, according as the vessel is destined for river or sea navigation. The decrease of the length of the horizontal axes of the ellipses should be in such gradation as that a line drawn from stem to stern, intercepting the ellipses at their acute points, shall be an elliptic curve. The entering timbers above the water line should correspond to those beneath it.

The improved propelling wheel consists of a flanged cylinder, fitted on its periphery with a number of floats, which may be convexed or concaved on their working surfaces. The longest perpendicular to the chord of the arc of these floats should equal the draught of the vessel. When the vessel is intended for canal navigation, one propeller is placed in the centre of the vessel, in which a suitable water-tight case is provided. The top of the case is fitted with a valve, which is closed by the pressure of the inside water, and opened when that pressure is removed, to admit the external atmospheric air to the wheel case. If the vessel is intended for river or sea-going purposes, she is to be fitted with two propelling wheels suitably encased.

The *Claims* are very voluminous, but may be reduced to; 1. The peculiar mould of the vessel; 2. The propelling wheel; and, 3. Encasing the propeller in cases furnished with collapse valves, as described.

JOHN ROBERTSON, Great Howard-street, Liverpool, cooper. *For improvements in the manufacture of casks and other wooden vessels, and in machinery for cutting wood for those purposes.* Patent dated July 29, 1848.

A machine for planing, at once, both sides of the pieces of wood of which the staves for casks or other vessels are intended to be formed, is first described. It consists of a framework which supports a horizontal table or series of rollers. At one end of the table is an endless chain, fitted with projections, which turns on two wheels driven from any prime mover. Above the table or rollers are placed a number of rollers, which adjust themselves to any inequality in thickness of the wood by means of springs, and thereby prevent it from jumping up.

Above and beneath the horizontal line of the table are fixed, at a suitable angle, a series of cutters. The edges of the top cutters are concave, and those of the bottom ones are convex, for the purpose of giving the requisite shape to the staves. The piece of wood is laid upon the endless band, and pushed forward, by the projections catching against it, along the table or rollers, and be-

tween the cutters, after which it is delivered at the other end of the machine. In order to prevent the tearing of the wood, each succeeding cutter in the top and bottom series is placed nearer to the horizontal line of the table until the two last would reduce the wood to the desired thickness, so that each may plane off a small portion only.

In a modification of this machine, the box carrying the cutters is made to travel to and fro over the wood, whereby one side of it is planed at the time.

The alternating to-and-fro movement is effected by means of an endless chain, turning on wheels, and fastened to a transverse bar, which is connected to the box by means of two arms.

The machine for planing and jointing the edges of the staves, consists of a frame supporting a table, on which the stave to be planed and jointed is held. The jointer slides to and fro on the table, and is fitted with four horizontal cutters, two of which are inclined in one direction, and two the reverse way. The wood is held at an angle inclined to the horizon when a transverse angle is desired to be obtained, and kept close to the cutters by the workman until finished. In this case, when the edge of the stave is required to be straight, the box travels to and fro in a straight slot in the table; but when it is desired to be curved, the slot must be circular.

The machine for compressing the staves into casks, consists of a frame rising from a sole plate, and carrying at top a cross head, in the centre of which is a bush, screwed on the inside, and fitted with a screw rod. The trusses are of half the height of the cask. The bottom one is made fast to the sole plate of the frame-work, while the top one is attached to the lower end of the screw rod, which is furnished with a handle, whereby it may be moved up or down in the guides of the frame. Each truss is divided vertically, to admit of the cask being taken out, and is of the necessary internal configuration for giving shape to the cask—that is to say, the diameters of the end circumferences of the trusses are less than those of the centre ones. At the top and bottom of the trusses, and on the inside, are grooves, in which the hoops intended to hold the cask together are placed. The top truss is lifted up, and the cask "raised" in the lower one, the staves having been previously softened by steam, water, or fire. The top truss, which is lipped at bottom, is then caused to descend by means of the screw rod, and thereby to gather the staves into it, and compress them into shape. The trusses are then separated vertically, and the cask, with the end hoops on, is removed, and finished in the usual way. It is proposed to employ sometimes inside trusses to the cask, which are composed of segmental pieces maintained in their position by suitable pyramidal wedges.

To compress the pieces of wood together intended to form the head, the patentee employs a smooth table, which carries a number of cross bars, and is furnished with a horizontal screw, working in a screwed bush, and fitted with a handle. The pieces of wood are laid upon the table, and kept down by means of wedges inserted between their top surfaces and the bottom surfaces of the bars; or the bars may be furnished with vertical screws for effecting the same purpose. The rod is then turned, by means of the hand, until the pieces are compressed sufficiently together.

The machine for cutting the heads to the requisite diameter and bevelling their edges, consist of two horizontal, circular, concentric tables, between which the head is held firmly by screws or otherwise. In the top frame of the machine are suspended a number of vertical cutters, which may be adjusted to any height and distance from the centre of the tables, according to the diameter desired to be given to the head. The bevils are cut on the edge by horizontal cutters inclined at an angle to each other. The tables and head are made to rotate by any prime mover through the intervention of suitable gearing.

In order to finish and cut the inside grooves on the ends of the cask, the patentee places it upon a rotating horizontal table, where it is securely held by blocks and chains. Outside the cask, and independent of the table, is a vertical slide, on which moves a box carrying the bevel and groove-cutting tools, which act against the inside circumference of the end of the cask, as it revolves.

The machine for punching the holes in the hoop iron, consists of a table with a hole in it, in which the punch works. This punch is attached to the end of a lever, which is made to rise and fall by a crank connected to the other end. On each side of the hole is a guide, and in front of it a stop, all of which are adjustable by set screws, so that the holes may always be punched in the centre of the hoop iron, and at regular distances from the end.

Claims.—The modes of constructing the different machines in the manner and for the purposes before described.

Richard Abbey, Slough, Buckinghamshire, brewer. *For improvements in preserving fermented and other liquids and matters in vessels.* Patent dated July 29, 1848; no specification enrolled.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Jan. 25	1747	M'Adam Brothers, and Co.	Soho Foundry, Belfast	Eccentric tappets for steam engines.
"	1748	John Hynam	6 and 7, Princes-square	Hexagonal hinged box for matches.
26.	1749	William Riddle	Whitefriars	Porte Flacon, or wine handle.
"	1750	William Dixon	Liverpool	Window ventilator.
"	1751	Ebenezer Rogers	Abercorn, Monmouthshire	Rest for the forward ends of loaded carriages while being tipped.
"	1752	Thomas Ash	Birmingham	Fastening for stair-carpets.
27	1753	Frost, Noakes, and Vincent	Brick-lane, Whitechapel	Steam pressure gauge.
29	1754	Rebecca and Emma Alcock	Doctors' Commons	Bust improver.
30	1755	Samuel Sheppard	Birmingham	Tap.
"	1756	Barwell and Co.	Northampton, Eagle Foundry	Heat-diffusing stove.
31	1757	J. Robinson and Co.	Commercial-road East	Improved waistcoat.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Pierre Frederic Gougy, of Paris, gentleman, for improvements in apparatus and machinery for lifting and moving heavy bodies, and for raising and displacing fluids. January 27; six months.

Richard Archibald Brooman, of the Patent Office, Fleet-street, London, patent agent, for certain improvements in the manufacture of artificial limbs. (Being a communication.) January 27; six months.

James Green Gibson, of Ardwicke, near Manchester, machinist, for certain improvements in machines used for preparing to be be spun and spinning cotton and other fibrous substances, and for preparing to be woven and weaving such substances when spun. January 27; six months.

Ewald Riepe, of Finsbury-square, Middlesex, merchant, for improvements in the manufacture of soap. January 30; six months.

Alexander Wilkins, brewer, and William Stacey, engineer, both of Bradford, Wilts, for a certain improvement or improvements applicable to heating and boiling of liquids of any kind or description. January 30; six months.

Lemuel Wellman Wright, of Chalford, Gloucester, civil engineer, for certain improvements in preparing various fibrous substances for spinning, and in machinery and apparatus connected therewith. January 30; six months.

William Kenworthy, of Blackburn, Lancaster, cotton spinner, for certain improvements in power looms for weaving. January 31; six months.

Henry Bessemer, of Baxter-house, Old St. Pancras-road, Middlesex, engineer, for certain improvements in the manufacture of glass, and in apparatus connected therewith. January 31; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM 4TH TO THE 19TH OF JAN., 1849.

Robert Angus Smith, of Manchester, for improvements in the application and preparation of coal tar. January 4; six months.

William Gilmour Wilson, of Port-Dundas, Glasgow, engineer, for improvements in the formation of moulds, and cores of moulds, for casting iron, and other substances. January 4; six months.

Edward Shunk, of Rochdale, Lancaster, chemist, for improvements in the manufacture of malleable iron, and in treating other products obtained in the process. January 8; six months.

David Yoolow Stewart, of Montrose, Scotland, iron founder, for improvements in the manufacture of moulds, and cores for casting iron, and other substances. January 10; six months.

John Mitchel, chemist, Henry Alderson, civil engineer, and Thomas Warriner Farmer, of Lyons' Wharf, Upper Fore-street, Lambeth, Surrey, for improvements in smelting copper. January 10; six months.

John Wright, of Camberwell, Surrey, engineer, for certain improvements in generating steam and evaporating fluids. January 10; six months.

Richard Roberts, of the globe works, Manchester, Lancaster, engineer, for certain improvements in and applicable to clocks and other timekeepers, in machinery or apparatus for winding clocks and hoisting weights, and for effecting telegraphic communication between distant clocks and places, otherwise than by electro-magnetism. January 11; four months.

Edward Slaughter, of the Avonside Iron Works, Bristol, engineer, for improvements in marine steam engines. January 12; six months.

Israel Kinsman, late of New York, but now of Ludgate-hill, London, merchant, for improvements in the construction of rotary engines, to be worked by steam, air, or other elastic fluid. (Communication.) January 12; six months.

Edward Smith, of Kentish Town, Middlesex, blind manufacturer, for improvements in window blinds, and in springs applicable to window blinds, doors, and other like purposes. January 16; six months.

Andrew Lamb, of Southampton, Hants, engineer, and William Alltoft Summers, of Millbrook, Southampton, engineers, for certain improvements in steam engines and steam boilers, and in certain apparatus connected therewith. January 16; six months.

William Edward Newton, 66, Chancery-lane, Middlesex, civil engineer, for improvements in the construction of stoves, grates, furnaces, or fire-places, for various useful purposes. (Communication.) January 17; six months.

Andrew Shanks, of Robert-street, Adelphi, Middlesex, engineer, for an improved mode of giving form to certain metals when in a fluid or molten state. January 17; six months.

James Hamilton, of London, civil engineer, for improvements in cutting wood. January 17; six months.

James Young, of Manchester, Lancaster, manufacturing chemist, for improvements in the preparation of certain materials, and in dyeing and printing. January 19; six months.

LIST OF PATENTS GRANTED FOR IRELAND FROM 1ST TO THE 20TH OF JAN., 1849.

Bartholomew Beniowski, of Bow-street, Covent-garden, Middlesex, major in the late Polish army, for certain improvements in the apparatus for and process of printing.

Joseph Simpson, of Manchester, civil engineer, and James Alfred Shipton, of the same place, for certain improvements in steam engines.

Charles Green, of Birmingham, of Warwick, patent brass tube manufacturer, and James Newman, of Birmingham, manufacturer, for improvements in the manufacture of a part or parts of railway wheels.

Carey M'Clellan, of Londonderry, for an improved corn mill.

William Edwards Staite, of Lombard-street, London, gent., for certain improvements in lighting, and in the apparatus used therein, parts of which are applicable to other useful purposes.

William Young, of the firm of Henry Bannerman and Sons, of Manchester, Lancaster, merchant, for certain improvements in machinery or apparatus for winding, balling, or spooling thread, yarn, or other fibrous materials.

NOTICES TO CORRESPONDENTS.

A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the Claims of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d. Postoffice Orders to be made payable at the Strand Office, to Joseph Clinton Robertson, of 166, Fleet-street.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co. Dublin; W. C. Campbell and Co., Hamburgh

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1331.] SATURDAY, FEBRUARY 10, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

STENSON'S PATENT IMPROVEMENTS IN STEAM ENGINES AND BOILERS.

Fig. 24.

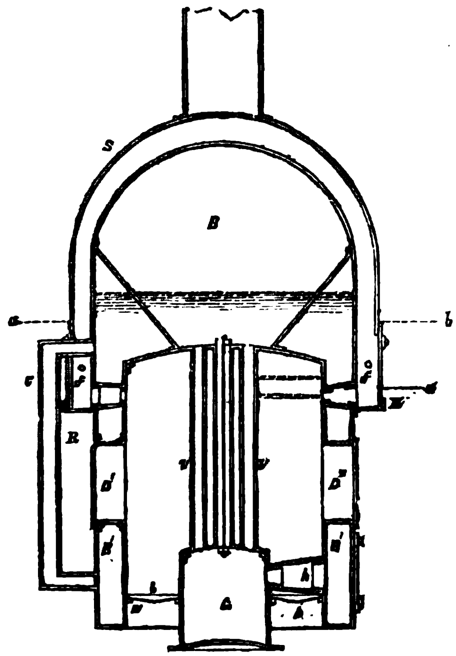


Fig. 28.

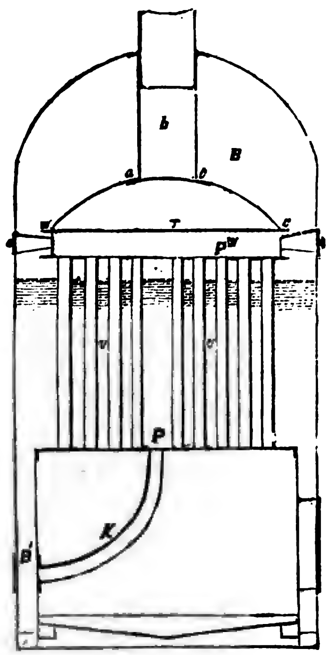


Fig. 25.

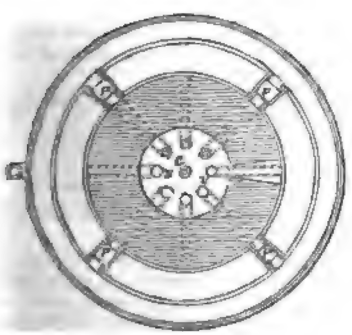
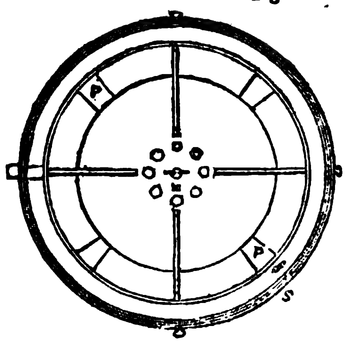


Fig. 26.



STENSON'S PATENT IMPROVEMENTS IN STEAM ENGINES AND BOILERS. (SECOND NOTICE.)

Rotary Emission Engine. (Claim Second.)

Another improvement relates to the class of rotary engines called emission engines. It consists in employing two emission wheels instead of one, as usual; of which wheels, one is keyed to the main axis and the other rotates freely upon it, being kept steam-tight by means of a stuffing-box. The two wheels are of the same diameter and revolve parallel to one another. The axis is hollow, and the arms and rims of the two wheels are also made hollow; the steam passing through the axis into the arms and thence into the rim. The rim of each wheel has two or more oblique emission ports, but the ports of the one wheel are placed at opposite quarters of the circle to those of the other, and those of the one wheel are also inclined the reverse way to those of the other, so that the two wheels when put in motion revolve necessarily in opposite directions. The outer face of the periphery of the one wheel, and the inner face of the periphery of the other, that is to say the opposite faces of the two wheels are indented after the manner of the buckets of an overshot water-wheel; and, consequently, the steam emitted from each wheel is projected against the bucket-faced periphery of the other, causing each wheel to serve as a fulcrum for the steam of the other to act against. The effective power of both wheels, is thus transferred to the axis, and may be transmitted thence to any working shaft through the medium of bevel-pinions driving a wheel, or by means of bands and pulleys, one pulley being keyed on the main shaft and the other keyed on the hub of the loose steam wheel, B^2, and a band from each pulley being carried over two other corresponding pulleys on another shaft, one of which bands is straight and the other crossed, in order to resolve the contrary motions of rotation into one revolving movement.

Oscillating Engines. (Claim Third.)

My invention in respect to oscillating cylinder engines consists in an improved mode of supporting and guiding the piston-rod. Fig. 10 is a front elevation, and fig. 11 a side-elevation of an oscillating engine (with the cylinder inclined at an angle of about 15 degrees) embodying this improvement. A, is a rectangular frame mounted on the top of the cylinder. D, a cross-head which is attached to the upper end of the piston and slides in grooves on the inner faces of the side posts of the frame, A. F is the working shaft which is supported on standards, and cranked at the centre as usual. The arms of the crank are secured by pins to the cross-head, D, so that as the piston moves in radial lines corresponding with the series of arcs described by the cylinder, it carries round the crank and its shaft along with it; and whatever may be the length of the stroke of the piston, the grooves in which the cross-head, D, slides, prevent it from being in the least warped or strained. By this arrangement the necessity of making very long stuffing-boxes in the cylinder covers, as is usual in engines with oscillating cylinders, is completely obviated, and great facility is afforded for any desired increase of length in the stroke. The parallelism which the cross-head and grooves serve to maintain, does away with the tendency of the piston-rod to wear the stuffing-box into an oval form.

Boilers. (Claim Fourth.)

My improvements in steam boilers have for their common object the obtaining of an increased amount of fire and flue surfaces, without increasing proportionally the size of the boiler, so that I am enabled to generate a greater quantity of steam, and with less fuel than can be accomplished by the form of steam boilers in ordinary use.

[Twelve different arrangements for this purpose are then described. They are all founded on very correct views of the processes of combustion and evaporation. We select the following for exemplification, as being on the whole the best:]—

Fig. 20 is an end view, and fig. 21 a side sectional elevation. A is the boiler, which is made with flat ends, and A^* an auxiliary generator, which is formed of two concentric cylinders, and communicates at C with the main body of water in the boiler. The flame and heated vapours pass first under the bottom of

the boiler to the back end, whence they are returned to the front end through the main flue, F, from which they are returned through the central flue, *f*, to the farther end of the boiler, and pass through *d* into an outer flue surrounding the boiler which leads to the chimney.

A small boiler, of a very suitable form

Fig. 11.

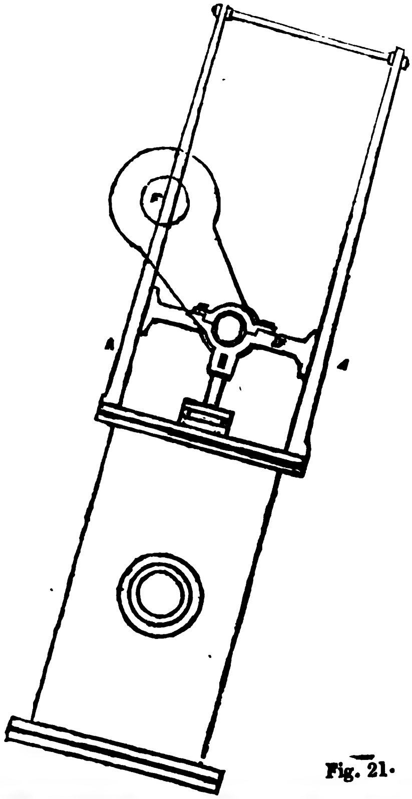


Fig. 10.

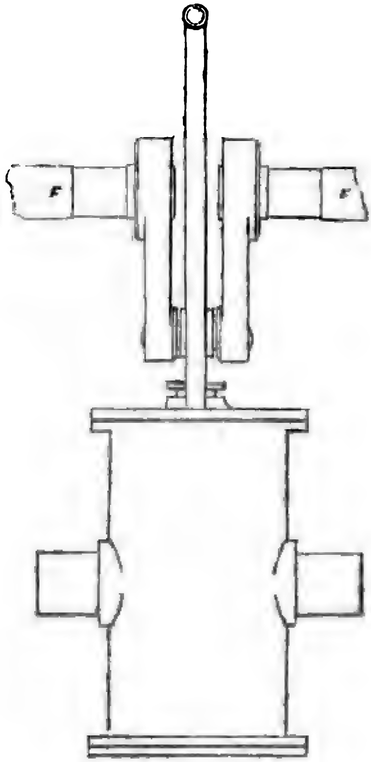


Fig. 21.

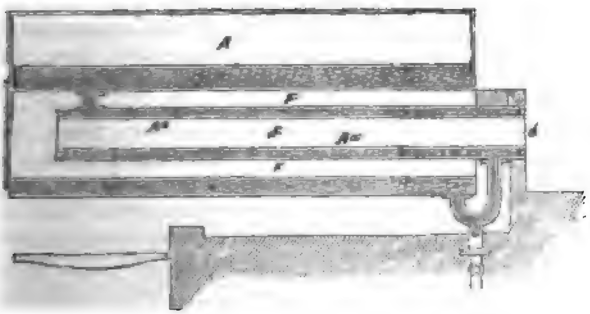
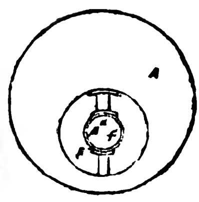


Fig. 20.



for portable engines, is represented in fig. 24 (a sectional elevation), fig. 25 (a transverse section on the line *c a*), and fig. 26 (a transverse section on the line *a b*.) B is the boiler, which is of a dome-shape, and encloses the fire-place, F, as

before. S is an iron sheet casing, which is dropped down over the top of the boiler, and secured to it by wrought iron stays. Round the under part of the outer casing there is a moveable hoop, H, which dips into a ring of metal, R, which encircles the body of the boiler, and is partly filled with sand, in order to seal thereby the space between the boiler and casing. G is an auxiliary generator, which is placed on the centre of the basement of the fire-place, and communicates by means of a circle of vertical tubes, *v, v, v*, with the water in the upper part of the boiler. A section of this generator is given in fig. 24. The fire-bars, *b b*, radiate from the generator as from a common centre, and are supported at their inner ends on a wrought iron hoop, *w*. D^1D^2 are two feed passages (closed with doors, as usual), which are made through the sides of the boiler and fire-place, and across the intermediate water spaces, B^1B^1, into the heart of the fire-place. I prefer having two of these passages, on account of the greater convenience which it affords for supplying fuel from either side to the fire bars. Water is supplied to the body of the boiler by a pipe, *f*, which is connected with a force pump placed in any convenient situation, and coiled once, twice, or oftener round the boiler, in the space between it and the sheet iron casing, S. The auxiliary generator obtains its supply of water from the body of the boiler through a pipe, *h*. The smoke and unconsumed gases ascend from the fire-place through passages, PPPP, into the space between the top of the boiler and the outer casing, S, and escape thence into the chimney. Sometimes I bend the tubes, *v, v, v*, over at the top, and pass them through the sides of the fire-place into the main water spaces, B^1B^1, as represented by the dotted lines in fig. 24. And sometimes, also, I add a central tube, *x* (see fig. 26), which is carried straight up, while the others only are turned over as last described.

A modification of the boiler last described is shown in fig. 28 (sectional elevation). B is a cylindrical boiler, with vertical fire tubes, *v v*, which lead at top into a dome-shaped smoke-box, T, enclosed within the steam dome of the boiler. From the top of the fire-box a pipe, *b*, rises, which leads to the chimney. The steam which collects in the top of the boiler becomes dried by the heat radiated from the smoke-box and chimney-pipe; and in this consists one great advantage of this form of boiler. K is a pipe, which conveys a constant supply of water from the side water space, B^1, of the boiler, up through the centre of the under tube-plate, P (room being made for it by the removal of one of the fire tubes). The water and steam diffused by this pipe preserve the bottom tube-plate, P, from becoming overheated, and thus reduces greatly the risk of its cracking. The dome of the fire-place is jointed to the sides and chimney-pipe at *a* and *c*, so that by undoing these joints, both the pipe and dome, or either of them, may be withdrawn for the purpose of cleansing, repairing, or replacing the tubes, *v v*, or the ferrules by which they are fastened into the upper tube-plate, P^2

Another mode of constructing a boiler so as to bring a large portion of the heat to bear on the steam in the top of the boiler, is shown in fig. 29. Here the heated vapours which collect in the smoke-box at the top of the fire tubes are carried by short lateral tubes, *bb*, into the space, *a'*, between the dome of the boiler and the outer iron casing, which space is sealed at bottom by a sand lute, as before.

(*To be concluded in our next.*)

DREDGE ON ROTARY ENGINES.*

The present pamphlet is stated to be an embodiment of the substance of a Report made professionally by the author on the performances of the rotary engine of Mr. Davies, described in our last volume (pp. 433, 451, 457, 481, 516), or, more strictly speaking, on a *single* piston engine constructed on the same principle; accompanied with some illustrative annotations and supplementary documents. Mr. Dredge owns that he went to see the engine, on which he was commissioned to report, " with some misgiving"—that " he felt little doubt in his own mind that his Report would be anything

* DAVIES'S ROTARY ENGINE. Being a Description of an Engine at Work at the Manufactory of Messrs. Edelsten and Williams, George-street, Birmingham. And also an Experimental Inquiry into the Principle of that Engine; with a View to ascertain its Relative Power and Useful Effect. By William Dredge, C.E. 42 pp., 8vo. With Numerous Engravings. Williams and Co.

but favourable, for, in common with many engineers, he had a strong opinion against rotary engines," but that "this prejudice was much shaken after seeing the engine at work, and subsequent experiments entirely dispelled it." Should the same impression be produced by these experiments on the public mind as has been produced on the mind of so intelligent a gentleman as Mr. Dredge, this pamphlet will form an era in the history of the steam engine, second only in interest and importance to Watt's invention of the separate cylinder condensing engine. It becomes incumbent on us, therefore, to place the grounds of Mr. Dredge's conversion to the Rotary Faith fully before our readers.

A preliminary chapter (I.) is devoted to "The General Principles of Rotary Steam Engines." The "general" position sought to be made out is, that there is nothing more inconsistent with the laws of physics in causing steam to act in a circular than in a rectilineal direction—indeed, less so; and that all the tangible objections to rotary engines resolve themselves into this, that there is a "difficulty of keeping the working parts steam-tight, and of lessening the great amount of friction," but which difficulty being "purely of a mechanical nature" may be "reasonably expected, ere long, to be overcome." We cannot say that we are much taken with this style of investigating the theory of the subject. We might say just as truly of the Irishman's gun, which could shoot round a corner, that there is nothing more inconsistent with the laws of physics in causing a ball to traverse a circle, than in making it go straight forward; no objection at all, except only the difficulty of loading, the immense friction and its inevitable result, the speedy shaking of the projectile to pieces. The "mechanical difficulty" is the all-in-all—the only thing, indeed, we have here to consider. And to the proofs, therefore, that it has been overcome—now and for the first time completely overcome—we shall at once proceed to draw the attention of our readers.

The engine of Mr. Davies, on which Mr. Dredge made his experiments, was, as we have said, a single piston one—that is to say, a central shaft, with one radial arm or rod, and piston attached to it, revolving within a steam cylinder, instead of two radial arms and pistons, or two steam abutments. Mr. Davies has had two patents: the first (April 27, 1844), was for the single piston arrangement; the second (May 2, 1848), of which we gave the full account in our last volume, was for the double. Both are on precisely the same general principle, but with some differences in the details, for which we must refer to our abstract of the specification of the second patent. These matters explained, let us now turn to Mr. Dredge's account of his experiments:—

Particulars of Experiments made with one of Davies's Engines.

The engine has been at work at Messrs. Edelsten and Williams's manufactory upwards of twelve months, and employed in turning wire blocks, pointing and heading machines, laths, &c.; the work which was on it when I saw it was about equal to ten horses.

On Wednesday, March 8th, 1848, whilst the ordinary work of the mill was upon the engine, the pressure of steam in the boiler being 18 lbs. per square inch, (which just gave sufficient power to the engine without any escape from the safety-valve,) I caused the quantity of water and the weight of the coals to be accurately registered, and found, be repeated experiments, that the quantity of water evaporated during that time was 9·8 cubic feet, and that the coal consumed was exactly 86 lbs. per hour.

The coal employed in the experiments was the ordinary Staffordshire engine slack, which cost, delivered at the manufactory, 5s. per ton. I have, however, thought it best to reduce it in calculation to the best Welsh coal, one pound of which, by experiment, is found to evaporate 9·5 lbs. of water; the quantity of coals, therefore, of this quality which would be consumed by the engine per hour is

$$\frac{9{\cdot}8 \times 62{\cdot}5}{9{\cdot}5} = 64{\cdot}47 \text{ lbs.}$$

The engine made seventy revolutions per minute. The annular space between the piston and exterior cylinder was, therefore, filled seventy times per minute; consequently $70 \times 60 \times 2 = 8{,}400$ cylinders of steam were consumed per hour.

The cubical contents of the annular space within each cylinder is 1,695 cubic feet;

but as the cam moves the steam stop, and closes the ports before the piston has completed its revolution, only ·6 of this space becomes filled with steam at the full pressure; but after the port is closed, the steam expands through an additional ·03 of the circle.

The quantity of steam consumed by the engine in one revolution of the piston is, therefore, $1{\cdot}695 \times 6 \times 2 = 2{\cdot}034$ cubic feet; whence the number of cubic feet of steam used by the engine per hour is, $2{\cdot}034 \times 70 \times 60 = 8542$. At a density of 18 lbs. per square inch, steam occupies a volume of 830 times as great as the volume of water from which it is raised. Hence $9{\cdot}8 \times 830 = 8134$ cubic feet is the volume which 9·8 cubic feet would occupy when raised into steam at a pressure of 18 lbs. per square inch; but the space it actually filled in the cylinder was 8,542 cubic feet, therefore the steam after leaving the boiler must have expanded from 8,134 to 8,542 cubic feet, and the elasticity being inversely as the space occupied, it follows that 17·14 lbs. was the pressure of the steam on each square inch on the piston.

The area of both pistons is $3{\cdot}5 \times 13 \times 2 = 91$ square inches, the distance through which the steam acts, or rather through which the centre of pressure of the steam acts in each revolution, is

$$\frac{\overset{\text{Ins.}}{17} + \overset{\text{Ins.}}{24}}{2} \times 3{\cdot}1416 \times {\cdot}6 = 3{\cdot}22 \text{ feet.}$$

Hence the mechanical effect, or the theoretical power of the engine,

$$\frac{17{\cdot}14 \times 91 \times 3{\cdot}22 \times 70}{33000} = 10{\cdot}65 \text{ horses.}$$

To which must be added the work done by the steam expanding after withdrawing the slide. This space, ·161 feet, is too small sensibly to affect the density of steam in the cylinder, and therefore it increases the power of the engine ·53 horses; which, added to 10·65, gives as the actual value 11·18 horses power.

In order satisfactorily to ascertain the amount of force absolutely expended, a friction break was applied.

The pressure of steam on the boiler and the speed of the engine were kept the same when the friction break was on, as they were during the day while driving the machinery in the manufactory, and the result was, that the friction break showed a power of 10·2 horses actually given off in doing useful work. From which it appears that about one horse power was absorbed in the waste, condensation, friction, &c., of the engine; or, in other words, that the useful mechanical effect given out by the engine was only about 10 per cent. less than the full mechanical power due to the steam.

The quantity of Welsh coal which would be consumed per hour is 64·47 lbs., which gives an average of 6·3 lbs. per horse power per hour. This is a small quantity of coal per hour for a high-pressure engine; but it is not that altogether which tests the value of the engine, for it is evident that the quantity of coal consumed must, in a great measure, depend on the evaporating power of the boiler.*

Beside the experiment just alluded to, several others were made with the friction break, the particulars of which are subjoined in the following Table (see next page):—

By comparing the columns 8 and 9 together, it will be seen that the absolute available power given out by the engine, and registered by the spring holding down the break, is within 10 or 12 per cent. of the full theoretical mechanical effect of the steam employed; for instance, when the pressure of steam in the boiler was 20 lbs., the available power given out and registered by the friction break was 11·27 horses of useful mechanical effect, the full force of the steam expended, supposing there was not any loss from friction, waste, &c., would be 12·44 horses, so that the entire loss by friction, with other extraneous resistances, was about, in this case, 11·1 per cent., and a considerable part of this case was expended in giving motion to the fly-wheel, pulleys and shafts in the engine-house, none of which was essential to the engine for the purpose of testing its power; but, in consequence of the difficulty of disconnecting them, they were allowed to run on it during the experiments. The small quantity of steam that is wasted in working this engine shows that the friction is not much; and from it we may say that the wear-and-tear of the rubbing surfaces are trivial, and this advantage, apart from the economy of working, promises much for the durability of the engine.

On this point, however, I thought it more satisfactory to examine the working parts of an engine erected in Bromsgrove-

* It is very much the practice in districts where the coal is cheap, to economise boiler space at the expense of fuel. In Staffordshire and the surrounding districts, for instance, the dimension of the boiler per horse power is much less than it would be in London or Cornwall, where coal is dearer. I do not stop to inquire if this is real economy, but such is the fact; and I believe I am correct in saying, that the duty performed by Davies's engine, at Messrs. Edelsten and Williams's (though it is a high-pressure engine) is greater than the average of low-pressure engines; or, in other words, that taking the average of low-pressure engines, they consume more than 6·3 lbs. per horse power per hour.

1 Number of experiments.	2 Pressure of steam on boiler, per square inch.	3 Number of revolutions of engine per minute.	4 Pressure of spring balance at end of break lever.	5 Mean pressure on spring balance.	6 Number of breaks on.	7 Weight of break.	8 Horse power given off by the engine.	9 Theoretical horse power of steam consumed.
1	30 lbs.	70	155 lbs.					
2	30 ,,	,,	153 ,,	153·75 lbs.	2	315 lbs.	15·99	17·35
3	30 ,,	,,	151 ,,					
4	30 ,,	,,	156 ,,					
5	25 ,,	,,	130 ,,					
6	25 ,,	,,	133 ,,	131·66 ,,	2	315 ,,	12·78	14·85
7	25 ,,	,,	131 ,,					
8	20 ,,	,,	110 ,,					
9	20 ,,	,,	110 ,,	109·33 ,,	1	175 ,,	11·27	12·44
10	20 ,,	,,	108 ,,					
11	18 ,,	,,	100 ,,					
12	18 ,,	,,	97 ,,	99 ,,	1	175 ,,	10·24	11·18
13	18 ,,	,,	100 ,,					
14	15 ,,	,,	80 ,,					
15	15 ,,	,,	80 ,,	80·25 ,,	1	175 ,,	8·36	9·30
16	15 ,,	,,	80 ,,					
17	15 ,,	,,	81 ,,					
18	15a	,,	37 ,,	37				
19	15a ,,	,,	37 ,,		1	175 ,,	4·04	
20	4b	,,						
21	2½c	,,						
22	1¾d	,,						

a. One engine was here detached, the steam acting only upon one piston.

b. The break was here removed, the engine running empty, with the exception of the fly-wheel and pulleys on the fly-wheel shaft, which it was inconvenient to disconnect.

c. Both engines were here in action, but running empty, with the exception of the fly-wheel, shaft, &c.

d. After the engine was fairly started, 1¾ lbs. pressure per square inch on the boiler kept up the speed.

street, made from the same patterns as the one described at work at Messrs. Edelsten and Williams's, but which had been employed for upwards of two years and a half in turning lathes, &c. I caused this to be taken asunder, and critically examined all the working parts.

The abrasure of the rubbing surfaces was not more than an equally well-made reciprocating engine would have sustained in the same time; *indeed, the engine was in as good a condition as it was when it was first started.*

It may, perhaps, be interesting to my readers if I here insert a correspondence which took place last spring between Messrs. Edelsten and Williams and myself on the subject of the engine at their works. I wrote to these gentlemen for information as regards the general working of the engine, and their reply is most satisfactory.

(COPY.)

London, 10, *Norfolk-street, Strand,*
20th April, 1848.

GENTLEMEN,

Having been called upon by Mr. Gibbins to examine and report upon the engine now at work in your manufactory at Birmingham, I did a short time ago examine it, and took such data of its power and construction as were necessary. The limited time, however, of my acquaintance with the engine prevents me from knowing how it performs its every-day work. I trust you will excuse the liberty I take in writing to you; and unless you have any reason to the contrary, be kind enough to reply to the following inquiries:—

1st. How long has the engine been at work? and,

2nd. Has it up to this time given you satisfaction? has it uniformly performed its duty? and if not, in what particular has it failed?

I ought to state, lest you have any objection, that this letter, and your reply will, in all probability, be embodied in my report to Mr. Gibbins.

I remain, Gentlemen,
Your very obedient servant,
(Signed) WILLIAM DREDGE.

Messrs. Edelsten and Williams."

(REPLY.)

New Hall Works, Birmingham,
April 27th, 1848.

DEAR SIR,

In reply to your inquiries respecting Davies's patent engine, we have the pleasure to say that it has been at work in our manufactory for six months, and continues to turn all our lathes, gearing, &c., with perfect ease, and always with the greatest regularity and smoothness, precisely in the same manner as when you looked over our premises in Birmingham a short time ago. It runs on an average ten hours a day, and has uniformly performed its duty to our entire satisfaction.

It gives us great pleasure in being able to speak in such unqualified terms of its general efficiency in doing the work of our manufactory.

Moreover it does not occupy one-fourth the space of an ordinary engine, and the economy in the consumption of fuel is considerable. With these combined advantages engines of this construc-

tion must certainly come into very general use in preference to any others.

We remain, dear Sir,

Yours most respectfully,

(Signed) EDELSTEN AND WILLIAMS.

W. Dredge, Esq.

This letter speaks for itself, and requires no observation upon it. Several months have since elapsed, during which the engine has daily performed its duty with equal regularity and satisfaction. And I would observe, that after having carefully considered every point in reference to this engine, and critically examined its practical and working details, both as regards its capability in giving off work, and its efficiency to withstand wear and tear, I can without hesitation express my unqualified approbation of Davies's engine; and certainly think that, ere long, it must maintain in the market a favourable competition with others.

The preceding statements embrace the period between the 20th Oct., 1847, and 20th April, 1848; we add another extract, which brings the use down to the 30th of Nov. last, a period of 13 months and 10 days:—

Before concluding my remarks, it may be as well to notice the performance of the engine at the present time. In reference to this, I have received copies of the following letters from Mr. Gibbins; the reply bearing strong testimony of the satisfaction the engine continues to give Messrs. Edelsten and Williams:—

Birmingham, 23*rd Nov.*, 1848.

ESTEEMED FRIENDS,

EDELSTEN AND WILLIAMS,

It is now upwards of twelve months since Davies's Rotary Engine, which we placed on your premises, has been in regular and constant work; and during this time you have had an opportunity of witnessing its operations, and can speak with certainty as to the performance of its duties. I shall therefore feel obliged if you will state in writing any particulars as to its efficiency and regularity of work, which your experience of it will justify. Be so kind as to do this in such a form as will enable us to make use of your testimony in the event of its being required.

Yours very truly,

(Signed) THOS. GIBBINS.

REPLY.

New Hall Works, George-street,
Birmingham, 30*th Nov.*, 1848.

DEAR SIR,

It is now upwards of twelve months since we commenced working Davies's Rotary Engine, and we have much pleasure in saying that it has uniformly performed its duty with the greatest regularity; *in fact, it is utterly impossible for any engine to work better.*

We have placed additional work upon it since we wrote to you in April last, so as further to test its capabilities, and this enables us fully to confirm the favourable opinion we then expressed; and we can confidently recommend it, *as being most efficient in every respect.*

In proportion to the increase of the power required, there has only been a corresponding increase in the consumption of fuel. We have had some of the most scientific and practical gentlemen in the country looking at the engine, who (although prejudiced against rotary engines) have expressed themselves not only greatly surprised, but generally satisfied with its regularity and efficiency. We are, dear Sir,

Yours most respectfully,

(Signed) EDELSTEN AND WILLIAMS.

Thos. Gibson, Esq.

I was in Birmingham on the 9th instant, and took that opportunity of again inspecting the engine. I found the work it has now to perform has been considerably increased since March last. I went over the manufactory, and should estimate the increase at about 25 per cent. The speed of the engine is still the same, namely, 70 revolutions per minute; but the pressure of steam in the boiler is increased to 22 lbs. per square inch. The slack consumed for fuel had been for some time weighed, and was found to average 102 lbs. per hour; which, as the engine is performing the duty of about twelve horses, is exactly 8·33 lbs. per horses power per hour.

The mill has been in constant work, on an average, ten hours daily; and the engine, from the time it was first started, has never caused any delay or stoppage to the machinery.

I particularly looked at the gland-packing, which is as good and as tight as when first put down; no steam escaping from the engine.

Being ourselves in Birmingham lately, we went to see this rotary wonder, and could not, after a most attentive inspection of its performances, find a single reason for doubting the perfect soundness of the practical conclusions at which Messrs. Edelsten and Williams and Mr. Dredge have arrived.

Here, therefore, we have this GREAT FACT established, namely, that a rotary engine has been at constant daily work for more than a twelvemonth—doing as much duty as the majority of reciprocating engines are capable of performing, and not only at less expense, but with less tear and wear. The gainsayers of rotary engines must either get over this GREAT FACT, or confess at once that their opposition is, in truth, a "prejudice" which, the sooner it is got rid of the better.

When we turn to Mr. Dredge's pamphlet for the "sufficient reasons" (as logicians would say) for the great superiority of Mr.

Davies's rotary engine over others of the same class, we find ourselves involved in a little difficulty. The "sufficient reasons" which Mr. Dredge gives are derived from the second specification (the piston packing only excepted), and not from the first; but it was according to the first that the engine, of whose performances we have been speaking, was constructed. Well—all that can be said, is this—if the engine did so well without the improvements embraced in the second patent, it must do still better with them. Of these improvements Mr. Dredge gives the following very correct estimate:—

The *first* claim to be noticed is the metallic gland stuffing-box for packing the revolving shaft to prevent escape of steam from the cylinder.

This is an important feature in the specification, and happily I am, from practical experience, able to speak of it with confidence.

I have tried many experiments with the packing in the engine at work at the factory of Messrs. Edelsten and Williams, which is furnished with it, and under a variety of circumstances, and with steam of various densities from 1¾ lbs. to 35 lbs. per square inch, I have invariably found it most efficient in its operations.

The shaft of the engine in George-street is 4½" in diameter; the depth of the packing rings 1½". The rings are divided into four segments, which are pressed from behind with spiral springs, so as to clip the shaft. I have occasionally had the engine at work, with steam of 30 lbs. per square inch, yet the packing held as tight as though it was only 3 or 4 lbs. The engine has been driven almost without intermission ten and, latterly, eleven hours daily since it was first started, yet I can safely affirm that no steam has escaped along the shaft past the packing.

I had suggested, that at the first opportunity, it would be advisable to look at the packing, in order to see the amount of wear to which it was subjected; accordingly, about a month since, the top cover of the packing-box was unscrewed, and the segmental pieces taken out, but neither they nor the shaft exhibited any symptoms of unequal wear; indeed, the surfaces were as true and perfect as when the engine was first started, which would not certainly have been the case had hemp-packing been used instead.

I have seen the shaft of a rotary engine cut into minute grooves by the fibres of hemp after only a few months' work, and the shaft at the bearings sensibly lessened, being reduced nearly one-eighth of an inch.

With respect to the metallic packing, I think it may fairly claim the following advantages:—

1st. It is neat; the stuffing-box projecting but an inch or two beyond the cylinder cover: the segmental rings are fitted when the engine is made, and being self-adjusting, require no attention on the part of the engine-man, except occasionally supplying the lubricator with oil.

2nd. The rubbing surfaces being got up perfectly true, the bearing is alike all over, and the packing does not cut into the shaft, neither does it cause the drag upon the engine that the hemp does, absorbing the force and wasting away the shaft.

3rd. It has been proved by experience to be efficient, being perfectly steam-tight.

Secondly. The method of attaching the piston to the main shaft by means of feathers, is also applied to the engine in George-street, and, as far as I could ascertain, answers well.

There are two advantages to which this seems entitled: 1st. If there is any end pressure on the shaft caused by machinery, it is not communicated to the piston, so that it revolves in a plane quite independent of all end movement of the shaft. This is important, inasmuch as if end pressure were communicated to the piston, the side would rub against the partition plate, and give rise to considerable friction and wear. 2nd. Since there are two pistons used, it would be very difficult if they were fixed to the shaft, to adjust both in a position, that when inclosed within the cylinder, they may revolve freely, just touching without unduly pressing against the partition plate and end cover of the cylinder; but since the piston is free to move along the shaft to a small extent, the adjusting screws in the end cover of the cylinder keep the outer side of the piston against the partition plate, at the same time that they set the end and adjustable plate of the cover against the near side of the piston; and, by this means, reduce the friction of the piston in revolving to a minimum consistent with steam tightness.

Though the use of the double-acting piston described in the specification makes two sets of movements necessary, yet for engines of great power it obviously possesses considerable advantages. The first advantage presented to us is, that as there are two ports open for the supply and eduction of steam, the annular space between the outer cylinder and the piston must be filled twice in each revolution. It follows, therefore, that a double acting piston gives forth twice the power that a single acting one of the

same size does. Again; if a very powerful engine were to be made single acting, its size would greatly interfere with the requisite accuracy of workmanship; and in working the engine, the steam would give an unequal pressure in respect to the main axle, *i. e.*, if steam were admitted through the port, and urging the piston round, the waste steam escaping through the return port, in the same stop, the pressure of the steam on the upper side of the piston would cause a downward pressure on the axle, and give rise to a considerable degree of friction. It is true, that where there are two pistons attached to the same shaft, the projections which are opposite each other, in a measure neutralize this action, but still not so effectually as when the steam acts on both sides of the piston at the same time, and within one cylinder.

Mr. Dredge disclaims having any wish to afford, by his pamphlet, "encouragement to inventors to speculate in rotary engines." (p. 6.) Why so? Why should he shrink from the only practical conclusion to which all his statements and all his reasonings so irresistibly lead? Nobody has ever questioned that, if rotary engines could but work as well as reciprocating ones, they would be preferable under all circumstances, and more especially so where *direct action* is desirable. And if Mr. Dredge has established the affirmative of this proposition (as we think he has gone far towards doing), why should he view it otherwise than as affording *the greatest possible* encouragement to inventors to emulate the success of Mr. Davies? For ourselves, we would say to all inventors whose thoughts are turned in this direction — *persevere*. Davies, like Watt, has done much; but he may expect, like Watt, to have a long line of successors and improvers.

ON MOUNTING GUNS ON THE NON-RECOIL PRINCIPLE.—SECOND SELECTION, FROM THE UNPUBLISHED PAPERS OF THE LATE BRIG.-GENERAL SIR SAMUEL BENTHAM, K.S.G. WITH NOTES.*

In regard to the mode of mounting guns—their efficiency, and, consequently, the success of a naval armament, will be found to depend on this particular in a degree far greater than seems to have been hitherto considered; and not only the quickness of firing, the accuracy of aim, and the diminution of the chance of injury from the enemy's shot, but also the number of guns, of the hands necessary for working them, and of the vessels required to produce a naval force of a given amount, will be found to be most essentially influenced by the manner in which the guns are mounted.

Of the different modes of mounting guns which have come to my knowledge, and of which the superior efficiency has been experienced, two modes present themselves as preferable to any others that I am acquainted with. One of these is the mounting the gun so as that it should have no recoil beyond that afforded by the elasticity of the matter by which the recoil is prevented; the other mode is the mounting the guns *in pairs*, attached one to each end of the same breeching, that breeching long enough to permit one gun to recoil to the situation most favourable for loading, and so that the recoil of that one gun shall draw out the other to the situation most proper for firing.* By either of these modes the time lost, as at present, in replacing the gun before its firing can be repeated, is altogether saved. Either of these modes appears to be preferable to the present mode of mounting guns on wheels, which, although they facilitate motion in a direction generally disadvantageous, afford no facility for traversing the gun for taking aim.†

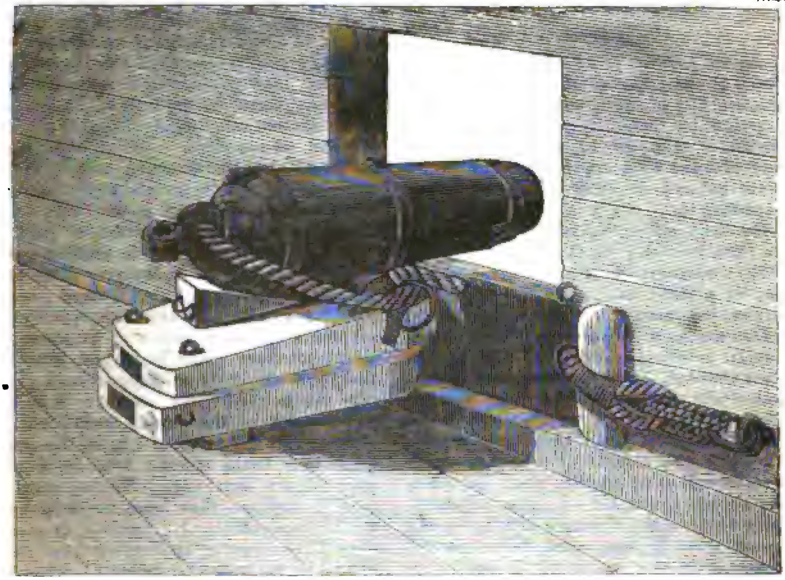
As to the mode by which the chance of injury from the enemy's shot may be diminished—that chance as far as it is calculable, will depend on the length of time the vessel, whilst firing the requisite number of shot, is exposed to the enemy's fire; as also to the more or less protection against the enemy's shot whilst so exposed. This length of time will depend, as above noticed, on the quickness of firing. The chance of being injured during that time, will depend on the quantity and quality of matter presented to the enemy's fire; that is on the thickness, and on the kind of materials of the vessel's side. This protection, even as at present, is sufficient to resist shot of some descriptions, and may be made to afford much greater resistance; but according to the present mode of mounting guns, the port-holes are, for the convenience of working those guns,

* For First Selection of papers on this subject, see our last volume, p. 634.

* See Note A. † Note B.

made so large as to leave considerable openings in the sides of the vessel, through which the enemy's shot may pass without any obstruction.

In the mode of mounting guns in pairs, if the platform, on which they slide during the recoil, remains fixed as to the direction in which the gun slides, so that they may be pointed by the motion of the vessel itself, the port-holes need be no broader than the diameter of the gun, and no higher than sufficient to admit of the little elevation or depression, according to the distance of the object aimed at; but if the gun, together with its sliding carriage or platform, be traversed to different angles, the port-hole must then be more extended to suit this purpose. When guns are mounted without recoil, so as to turn on a pivot to fire in various directions, the exposure to the enemy's shot is evidently much increased. But in this case a kind of bulwark might be introduced, in the form of a segment of a circle, so as to traverse with the gun round the pivot on which it turns.



As to the influence which the mode of mounting the guns may have on the number of guns, on the hands to work them, and of vessels to bring them to action on the enemy, the advantage of one mode in preference to another, in as far as is calculable, is exactly in proportion to the number of shot of a given weight, which according to each mode may be fired in a given time—since it must be evident that it is not the number of *vessels*, by means of which the guns are brought within reach of the enemy, that constitute the force of the armament, but the number of the most *efficient shots* that can be fired in a *given time*. According to either of the two modes of mounting above specified, experience has shown that one-third of the number of hands requisite, according to the usual mode, would suffice for throwing a far greater number of shot, in a given time, by either of the two modes in question.

Note A.

That the efficiency of a naval force depends essentially on the number of shot of *great diameter* that can be thrown in a given time, was long and strenuously advocated by Sir Samuel Bentham, and it may be presumed that his official letters on the subject, together with the urgency of his verbal representations to ministers, have had no small share in the gradual introduction of powerful artillery in naval armaments. This improvement is, however, still in a manner confined to vessels purposely built for war; yet it is equally applicable and

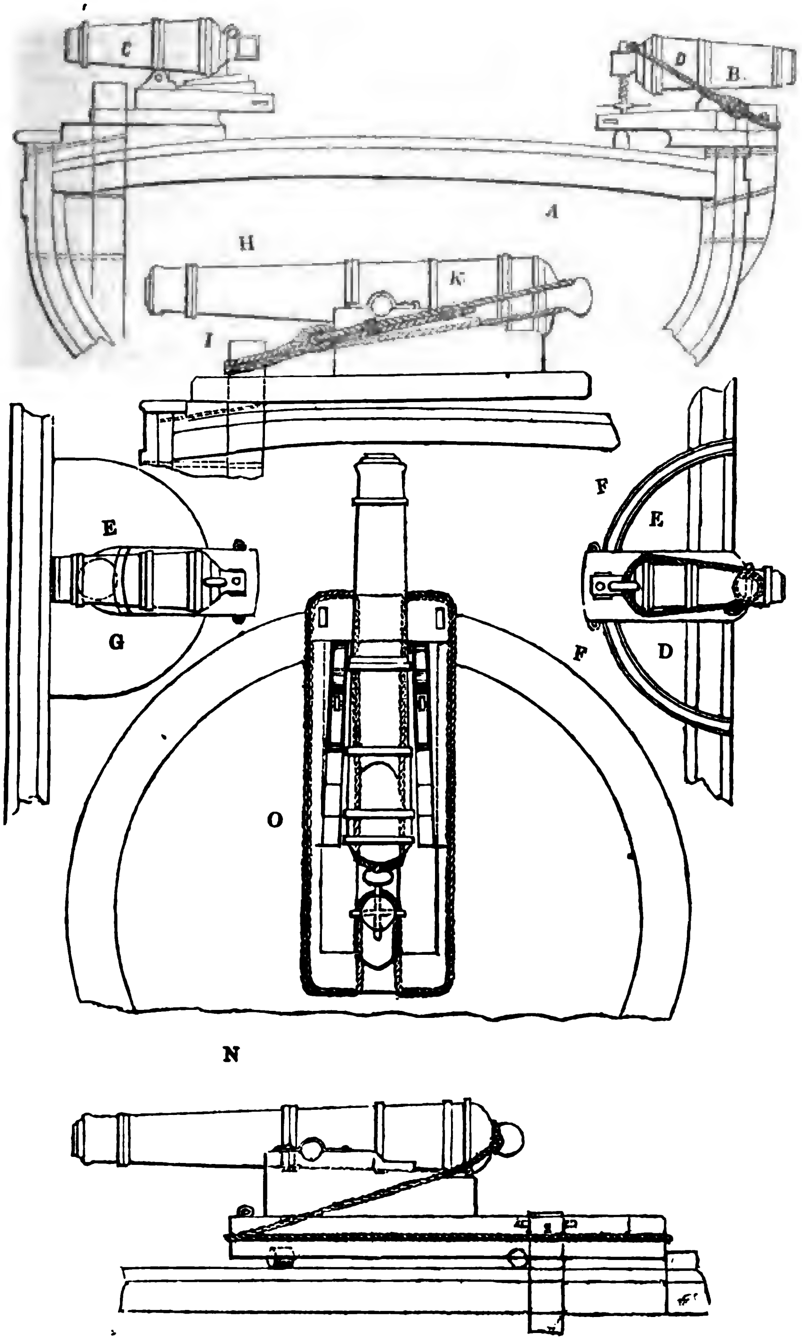
desirable in the instance of small craft, so that on an emergency, a very powerful force might speedily be fitted out at very small expense. That the creation of a formidable flotilla has been actually thus effected, is shown by a Note to his "Naval Essay." As that Essay is not now to be procured, a reprint of the Note may be acceptable to many readers, considering the general interest at present taken in all questions relative to our navy. The Note is of importance also, as proving that General Bentham's plan of making the recoil of one gun run out another (regarded by many as utterly chimerical), has, in fact, been successfully reduced to practice.

Note.

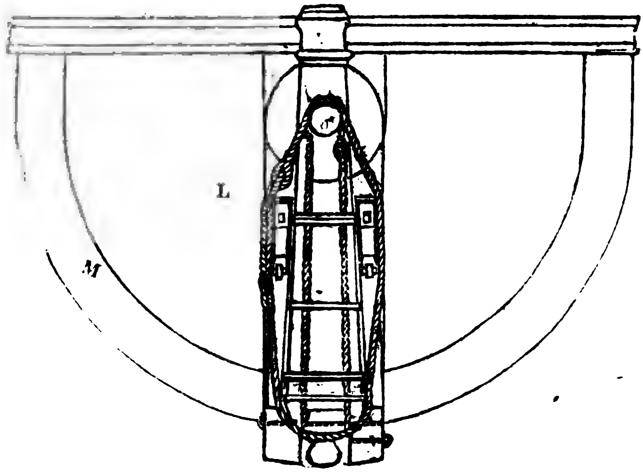
As to positive proof afforded by experience of the superior efficiency, as well as practicability of substituting guns throwing large shot for those only capable of throwing small ones, as my own experience happens to have afforded what appears apposite proof, I am induced to enter into some details respecting it.

On the breaking out of the war between the Russians and the Turks, in the year 1787, a concurrence of circumstances gave me, for a short time, although in the land service, the command of the naval arsenal at Cherson, so as to put at my disposal such vessels, artillery, stores, and men as the place afforded, for the purpose of creating a flotilla with the utmost dispatch; this flotilla was intended, if possible, to afford protection to that part of the country against the threatened attacks of a very powerful fleet, as well as of a flotilla which the Turks had already at sea, and to oppose which the few Russian ships of war, which lay at the mouth of the Dnieper, were, from their imperfect state of preparation, as well as on account of their great draught of water, little to be depended on in action on this coast. As to the vessels of which the flotilla was to be created, some large boats and small sailing vessels were already ordered to be built; but in the mean time, the only ones in any degree applicable to the purpose, were seven pleasure galleys, in which the Empress Catharine and her suite had descended the Dnieper on her way to the Crimea; eight barges or lighters, which had been used to convey luggage on the same occasion, as also five or six men-of-wars' long boats.

On taking upon me the formation of this flotilla, I found that the ship-building department had considered that three or four pounders were the largest guns which the vessels in question were capable of carrying. Accordingly, they were some of them, when put into my hands, already prepared for mounting ten or twelve such guns; the more or less efficiency of the mode of arming not being there, more than elsewhere, required to be kept in view by those entrusted with the construction of ships. On my part, responsible as I, on the contrary, made myself for the efficiency of the armament, the preparation of which was thus confided to me individually, and considering that, particularly against such a force as it had to oppose, efficiency could only arise from the number and weight of the shot which could be thrown, my first step was to examine not merely the boats and barges—that is, the vessels which were to be armed—but particularly the implements of destruction to be found among the stores of the ordnance there. I found abundance of 18-pounders and 36-pounders, prepared for sea service, and for land service; light brass mortars, throwing shells of from 9 to 13 inches, howitzers and other light pieces, 48-pounders and 96-pounders, most of which were prepared also for throwing hollow shells, some filled with materials for explosion, some for combustion; it was with these several most destructive pieces of artillery that I determined to arm the craft in question. The ship-building department, indeed, as might be expected, urged their professional conviction of the impossibility of mounting any such pieces of ordnance on board of these boats or barges, asserting that the decks could not support such guns, nor the bottoms any mortar; that the half-breadth of the vessels would not be sufficient for the recoil of any of the guns, since they could scarcely ever be *housed* clear of the hatchway. Having satisfied myself, however, that these obstacles were not insurmountable, I proceeded to mount these large pieces of artillery on these small vessels in the following manner. The galleys already armed with one 8-inch and two 4½-inch howitzers, besides six or eight 3-pounders, I left, for want of time, as they were;—the barges—77 feet long, 22 feet 6 inches broad, 5 feet 4 inches deep—were strengthened by the addition of a few pillars under the deck; the hatchways were removed from the middle to the sides, thus leaving nearly the whole breadth of the deck free for recoil; on board six of them were mounted eight long guns, 36-pounders, four on each side, to recoil; the four on one side placed, *not* opposite to the four on the other, but opposite to the middle of the intermediate spaces; on board two of them, I mounted six 18-pounders, three on each side, with a 13-inch mortar in the middle, as usual without recoil, having first strengthened the middle by a little frame-work, in addition to which I mounted also on each of


C
D
B
A
H
K
I
E
G
F
E
F
D
O
N

these two vessels two 36-pounders, as bow-chasers, so as to slide in grooves, one on each side the middle line of the vessel, and attached one of these 36-pounders at each end of a single breeching passed over a shieve fastened to the stem of the vessel, so that the recoil of one of these guns drew out the other, whereby the loading was effected entirely within board, and no labour or time was lost in replacing the guns after recoil. The common ships' long boats were armed each with one large piece of ordnance, either a howitzer or a mortar, fixed *without recoil;* on one of them, a mortar of the largest bore used for land service. These different pieces of ordnance were mounted all of them on board these boats without any distinct carriage, by bedding the trunnions of the piece in two fore-and-aft bulk-heads, placed at the distance from each other suited to the breadth of the piece, and they were fired either point blank, or at small elevations.



Having, when these fittings were completed, had the command of this flotilla next under Prince Nassau Siegen (to whom, though only a volunteer, was given, when he joined me, the honorary command), I had sufficient experience of the efficiency of the modes of arming adopted, particularly of the 36-pounders mounted to draw out one the other alternately (having pointed them myself on board my own vessel in this most important action); and as no time was lost in moving the guns for any purpose, either in the vessel where the recoil was made useful, or in others where there was no recoil, so great was the number of shot thrown by them that, I am confident, they did more mischief to the enemy than could have been done by vessels armed with twenty such guns mounted in the usual way. As to the actual efficiency experienced of the flotilla thus armed, besides the overcoming a flotilla of the Turks three times more numerous, the effect was, in regard to the Turkish ships of the line, the sinking one, the taking one (in which afterwards sixty-eight guns were mounted), and the burning seven.

This flotilla afforded an example, also, of the superiority, in point of efficiency, of small vessels over large ones. The Turkish ships of the line, although armed as usual, and making the best use of their guns, got aground, and consequently, we did not fail to take advantage of the shallowness of our vessels by placing them in that position in which few of the enemy's guns could be directed against us, and the smallness of our vessels gave us the farther advantage of being less likely to be hit by the enemy's shot.

To the English public the success of Russians against Turks, and that at a period now so long past, may be a matter of very little interest; but the *cause* of that success I look upon as highly deserving the attention of every one who interests himself in

the efficiency of our naval force. On the occasion of any such extraordinary success in warfare, it is usual to attribute it to the military ardour and skill of the commanders and their crews; but in this case I think it must be admitted that, had the vessels been armed as they would have been in the official course of business, although every individual combatant had been a hero, the Turks in all probability would, according to their orders, and considering their great force, have first destroyed this flotilla on their way to Cherson, and then have established themselves, for a time, at least, in that part of the country. To what, then, can be attributed the success of these small vessels, but to the mode of arming them?

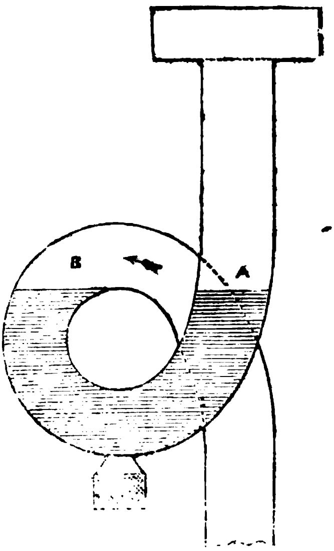
[For some further particulars of the above mentioned victory, see *United Service Journal*, 1829, Part II., p. 333.]

Note B.

The accompanying engravings illustrative of the manner of mounting guns on the non-recoil principle, have been made from a sheet of sketches found among General Bentham's papers, headed thus, "Drawings of the Recoil Eighteen Pounder Guns and Carronades as fitted by Mr. Fearnall on board Gun Vessels for the Defence of Ireland in the years 1803 and 1804, under the orders of Admiral Whitshed."

A, is a section of a gun vessel. B, an eighteen pounder carronade, fitted with a post bolted on the outside of the vessel, with a sweep on the deck for the tram of the carriage to traverse on; the forepart of the carriage traverses on the gunwale. C, an eighteen pounder carronade fitted with a post bolted on the inside of the vessel, with a solid sweep on the deck for the carriage to traverse on. D, breeching of six-inch rope round the carronade and post. E, plan of the carronades. F, sweep upon which the carriage is to traverse. G, solid sweep. H, elevation of an eighteen pounder gun mounted on a fir carriage, with jaws in front to keep it to its centre in training. I, an oak post, round which the breeching is made fast and placed at a sufficient distance from the side of the vessel to admit of the gun being trained fore and aft. K, breeching of 7½ inches of rope. L, plan of an eighteen pounder gun, showing the manner in which the breechings are passed. M, sweep on the deck for the cast iron rollers in the train of the carriage to traverse on. N, elevation of an eighteen pounder gun mounted on a traversing carriage, fitted in the middle of the deck, and intended to fire at every point of the compass. O, plan of the same.

SIMPLE EFFLUVIA TRAP FOR KITCHENS.



Sir,—Sanitary reform being now the order of the day, I send you a description of a very simple and efficient plan which I have adopted in order to prevent the nauseous effluvia which used to ascend into my kitchen through the slop-stone pipe, the drain of which communicates with the one proceeding from a church-yard. This I have accomplished by merely turning the slop-stone pipe into the form above represented, and attaching a plug-piece and plug at the bottom of the curve, for the purpose of emptying any sediment which may collect in the curve; to prevent which, however, I adapt a fine grate to the top of the pipe. It appears to me that this is so cheap and efficient a plan, that many of the readers of your valuable work will be very likely to adopt it.

I may, perhaps, better add, that its *modus operandi* is based upon the simple law that water, if unobstructed, will find its own level; that the water entering at the point A, forces the water over the curve at B, and that thus the water flows freely, whilst the curve of the pipe being always full to the level of the point of effluxion, prevents the bad air passing up the pipe.

I am, Sir, yours, &c.,

JOHN BEVERLEY.

Enfield, near Blackburn,
Jan. 24, 1849.

ABSTRACT OF THE STEAM LOG OF U. S. STEAMER, "MISSISSIPPI," FROM PENSACOLA TO VERA CRUZ.*

1846. Date.	Hours in operation.	Average pressure of steam.	Cutting off at.	Revolutions made.	Knots run.	Average speed per hour.	Revolutions per knot.	Coal expended in pounds.	Coal expended in tons.	Pounds of coal per hour.	Pounds of coal per knot.	Pounds of coal per revolutions.	Per cent of ashes and clinkers.	Ship drawing.	Dip of paddles.	Per cent of slip of paddles.	Effective pressure on piston in pounds per square inch.	Horses power exerted.	Coal per horse power per hour.	Pounds of water evaporated by one lb. of coal.	Pounds of coal to evaporate one cubic foot of water.	Cubic feet of water evaporated in 24 hours.	Cubic inches water per revolution.	Water blown out in cubic feet in 24 hours.	Water blowing cubic feet per hour.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Oct. 1st.	16	10	2—8	9679	120	7·5	80·65	37290	21·75	2325	310·8	3·84	7·86	19—7½	6—6½	5·71	13·8	454	5·12	5·1	12·1	3065·9	547·3		210·3
2	24	12·5	2—8	15040	181	7·5	83·1	58575	26·15	2441	323·6	3·9	11·17	19—5¾	6—4¾	8·4	15·6	481	5·08	5·54	11·5	5196	603·6	5975	249
3	24	12·8	2—8	15770	186	7·75	83·7	59400	26·52	2475	319·3	3·76	13	19—4	6—3	9·1	15·9	516	4·8	5·8	10·7	5570·4	610·3	6405·9	266·9
4	24	12·5	2—8	15570	178·25	7·42	87·3	63696	28·87	2654	357·3	4·1	11·73	19—2	6—1	12·9	15·6	499	5·3	5·28	11·8	5387	603·6	6195	258·1
5	24	11·7	2—8	15320	170·75	7·34	89·7	67045	30·	2794	392·6	4·37	13·	19	5—11	15·2	15			4·83	12·9	5192	585·6	5970·8	248·7

Remarks.

Oct. 1st., P.M. 7. 10. Set topsails, foresail and jib, with light moderate breeze on larboard quarter. A.M., same.

2nd ,, Moderate breeze on larboard quarter. 12. 45 hauled down the jib. A.M., same.

3rd ,, Moderate breezes 1. 10, set main spencer. A.M., light breezes 2. 15, brailed up main spencer, 10. 40, clewed up and furled all sail.

4th ,, Light variable winds and light airs. A.M., same.

5th ,, Same as previous day.

Dimensions of Ship.

Length between perpendiculars	220	feet.	
Breadth of Beam	40	,,	
Depth of Hold	23	,,	6 in.
Diameter of Cylinders			75 ,,
Length of Stroke	7	,,	,,

The Coal used was Pittsburg.

The quantity of water evaporated was calculated from the volume described by the piston without any allowance whatever, and therefore is not literally correct. Allowances ought also to be made for the heat lost by blowing, and for water passing through mechanically mixed with the steam.

The water was kept very fresh in the boilers, ranging about 1¾, or less than 2 parts salt in 32 parts water.

The friction of the engine, including the power required to work the air-pump is taken at 2·25 lbs. per square inch of piston—the back pressure in the cylinder at 4 lbs. per square inch.

WILLIAM SEWELL, JUN.,
Chief Engineer, U. S. Navy.

* We have been obligingly favoured with this document by an Engineer of the United States Navy, and publish it for the information of the Officers of our own Steam Naval Service, who, by comparing the figures here given with the results of their own practice, will be able to gather from them some matter for reflection, if not for self-congratulation. —ED. N. M.

RAILWAY SIGNALS.

Sir,—In 1847, I wrote a letter on this subject, which appeared in many provincial, and in one or two London newspapers, in which I suggested a simple means for effecting a communication between passengers, travelling by railway, and the guard (or signal man) of the train. As nothing practical has arisen out of my suggestions, or those of any other person, I am induced to forward you the present, to call attention again to the subject.

No one will deny that abstractedly it is desirable to have such a means of communication as above. In order to effect this, I propose to have a signal of the ordinary kind in use on railways, namely, a circular flat piece of zinc or other metal of suitable size (say 12 ins. in diameter) and painted, to render it more easily visible on the roof of every carriage, and fixed on a vertical rod or spindle, moveable from the inside to the extent perhaps of a quarter of a circle, and capable of turning the signal at right angles to the line of vision, and thus face the guards. When not in requisition it would stand edgeways, and present only a line to the sight. This I propose for the day signal.

For a signal by night, a lamp or lantern, fixed on the same rod or spindle, immediately under and adjoining the day-signal, may be easily contrived. Thus; let the lamp have three sides dark, and in the fourth a bull's-eye red light, with a reflector. When required to give an alarm, the spindle or rod is moved from within, and the red light is shown through a hole in one side of the box or case placed to protect the lamp from the weather; the hole in the case to be glazed with plain glass. The guard would instantly perceive from which carriage an alarm was raised, and descend from his watch-box (which is elevated a little above the roofs of the carriages, and constructed either on the tender or the first carriage, as the case may be) to ascertain the cause of alarm; and, if he deemed it expedient, stop the train. Steps should be constructed the full length of each carriage; and a rail put, say breast high, also the length of every carriage; and therefore both the steps and the rail extending to the entire length of every train. By this arrangement the guard could go to any part of a train in perfect safety.

It will be seen that an objection, often urged by those who disapprove of my plan, because it would put it in the power of idle persons to stop the train whenever they might think proper, or for a freak, or any idle excuse, is met; because the guard would use his discretion and stop the train, or not, according to the necessity of the case.

Connecting-rods may be contrived to act on the vertical spindle, or rod, from every compartment of a carriage.

It should be made punishable, by fine or otherwise, to raise an alarm without reason.

It would not be attended with any great outlay to carry out the plans here proposed; and I believe they would be found practicable and answer the end desired.

The travelling public have a right to expect that there should be some such provision as above; and I should be thankful to find that directors of railway companies carried out the suggestions I have made.

I am, Sir, yours, &c.,
EMANUEL DOMMETT.

3, Red Lion-square,
February 1, 1849.

P. S. — Since writing the above, a friend has informed me that the longitudinal step and rail are applied to railway carriages on many of the lines on the Continent.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED BETWEEN FRIDAY, FEB. 2, AND FRIDAY, FEB. 9.

EDWARD GRIBBEN WILSON, Bury, Lancashire, tin-plate worker. *For certain improvements in the construction of tin drums or rollers used in the machinery for drawing, spinning, doubling, twisting, and throwing cotton, wool, silk, flax, and other fibrous substances.* Patent dated August 1, 1848.

The patentee remarks, that tin drums, as hitherto manufactured, are composed of several tin plates, soldered together, and are, consequently, liable to be distorted or broken. Moreover, the driving band imparts an irregular motion to the spindle, in consequence of its passing over the projections or into the crevices of the drum, which are occasioned by the seams of the plates. For instance, an ordinary tin drum, 12 feet long and 9 inches in diameter, is composed of 36 tin plates; now, the present invention consists—

1. In making the drum of any number of

tin plates (less than four), and of the length of the drum; these plates are soldered together, and rounded in a suitable lathe, whereby, it is stated, the drum will be of greater strength and durability, and a more uniform driving motion be obtained.

2. The driving pulleys of the throstle spindles of self-acting and other mules are made in one piece with the rim of the drum, instead of being constructed of several pieces and soldered thereto.

Claims.—1. The method of manufacturing tin drums used in the above named machinery of larger sized tin plates than has hitherto been customary, so as to have fewer seams or joints, and rounding them in suitable lathes.

2. Forming the driving pulley in mules of one piece with the rim of the body of the drum.

Duncan Mackenzie, Goodman's-fields, Middlesex, manufacturer. *For certain improvements in Jacquard machinery for figuring fabrics and tissues generally, and apparatus for transmission of designs to said Jacquard machinery, parts of which are applicable to playing musical instruments, and composing printing types, and other like purposes.* (A communication.) Patent dated August 5, 1848.

In ordinary Jacquard looms the design is produced upon the fabric in the operation of weaving by causing some of the warp threads to be raised and the rest to remain stationary, as the case may be; and this is effected through the medium of certain horizontal bars or needles, which are thrust backwards or allowed to remain stationary by the to-and-fro movement of the revolving bar or prismatic box, commonly used in such machines, and which is pierced with holes on each face, over which pass the cards, also perforated according to the pattern desired to be produced on the fabric. Now, the present invention consists, *firstly*, in substituting for the revolving bar and cards a number of compound needles, which are so suspended in the end of the batten as to allow them to rise and fall a short distance therein. The portion of the inside of the batten opposite to the horizontal needles, which determines the position of the warp threads, is pierced with numerous holes to allow of their ends entering and being held therein. The compound needles are fitted with crossheads, which close or open the holes in the batten as the case may be. Beneath the points of these needles is a roller also pierced with holes, over which passes the pattern, having the design punctured in it in a similar manner to the cards, and which may be composed of paper, gutta percha, or other suitable material. Supposing the machine to be ready for working, that is, all the holes in the inside portion of the batten closed by the crossheads of the compound needles, then, on rotary motion being communicated to the roller, a portion of the perforated pattern will be brought immediately over some of the holes in the roller, and the rest will be closed by the unperforated portion of the pattern. The lower ends of some of the compound needles will then pass through the holes in the pattern into those of the roller, and by so doing will cause their extremities to slide down and leave the corresponding holes in the inside surface of the batten at liberty to receive the ends of the corresponding needles of the lifting bars, while the upper ends of those compound needles, which are maintained in their first position by their lower extremities, being in contact with the unperforated portion of the pattern, and thereby prevented from sliding into the holes of the roller, will strike against the ends of the corresponding needles of the lifting bars, and force them backwards in the same manner as is done by the unperforated portions of the cards in the ordinary Jacquard loom. The compound needles may be brought back into their original position, by any suitable mechanism, ready to be acted on by the succeeding portion of the pattern, which will be brought into position by the revolution of the roller, or the roller may be dropped down a short distance, so as to take the compound needles out of the holes, and then, while the frame or batten is being brought down, again to bring the succeeding portion of the pattern into the position of the preceding portion. The holes in the inside face of the batten, which admit of the free entry of the needles of the lifting bars, are, it will be observed, precisely those, the lower ends of whose corresponding compound needles have passed through the holes in the pattern into those of the roller, that is to say, the free holes in the inside face of the batten correspond exactly with those of the pattern; wherefore, when it is desirable to renew the pattern, a piece of paper or other suitable material of the size of the pattern is caused to pass between the ends of the needles, and the holes in the inside face of the batten, whereby the design of the pattern on the roller will be pierced upon the paper. The progress of the paper to be pierced is of course regulated by that of the pattern over the roller. Instead of the inside face of the batten being perforated, it may be entirely removed, and the compound needles arranged in such manner that their upper extremities may be exactly opposite to those of the needles of the lifting bars, and that when any of them are displaced by their ends passing

through the pattern, the corresponding needles of the lifting bars may take into the spaces thus left between the compound needles.

Secondly. The said invention consists in substituting the following arrangements for those before described: Upon a fixed axle, replacing the axle of the revolving bar in ordinary Jacquard looms, is supported a front plate with slotted holes, in which are guided the crossheads of the needles. These needles, work in the same manner and effect the same object, as the compound needles before decribed, but differ from them inasmuch as that their stems do not branch out. To the bottom of a longitudinal rod is fixed a perforated plate through which pass the lower portions of the needles, while another longitudinal rod carries a spring which serves to keep the surface of the pattern perfectly regular and smooth during its passage over a fixed plate, which is perforated and arched at its two longest sides, and which, serving as a support to the pattern, takes the place of the perforated cylinder before described. Upon a revolving shaft are keyed two pitch wheels and a stop and serrated wheel. Rotary motion is communicated to the shaft by means of a catch which partakes of the to-and-fro movement of the carrying frame of the revolving bar and acts upon the serrated wheel. It follows that the pitch wheels will partake of this rotary motion, and bring successively the different portions of the pattern (which is made in the form of an endless band) over the fixed plate. When some of the holes in the pattern come immediately over those in the fixed plate, the corresponding needles will fall through, and the design be produced upon the fabric. A rising and falling movement is communicated to the front plate, which lifts the needles up out of the pattern, when the design is completed, and allows the wheels to bring the next succeeding portion of the pattern into its place. During the retrograde action of the machine, the main shaft is held firmly by a catch taking into the indentations of the stop wheel.

The spaces left in the slots of the front plate by the crossheads of the needles, in consequence of their lower extremities passing through the perforated pattern into the fixed plate, correspond exactly with the perforations in the pattern; wherefore, if a portion of paper, or any other suitable material, be caused to pass between the horizontal needles and the front plate, and at the same speed as that of the pattern over the fixed plate, it follows that the pattern will be reproduced upon this piece of paper or other suitable material.

Thirdly. The said invention consists in the application of the improved Jacquard machinery, before described, to the playing of organs and other like musical instruments, in which the note is produced by a pin projecting from the barrel coming into contact with the spindle of the air valve, or with the tone-giving or sonorous substance—a method of effecting the change of tunes which is alike difficult and expensive. Now it will be evident that if, for example, the ends of any number of needles (constructed and disposed in a manner similar to those which determine the position of the warp threads) are made to strike against any sonorous substance, such as the strings of a piano or the metal teeth in an organ, and that if the tune be punctured upon the endless band, after the fashion of the design to be woven in the fabric, tunes may be played and varied at pleasure.

Fourthly. The said invention consists of a reading machine for determining the exact position in which holes are to be perforated on some fabric or material, such as paper, gutta percha, &c., which is not so costly as card, but sufficiently strong to enable it, when applied to a Jacquard apparatus, to force back the needles where no holes have been made in such paper, or other fabric or material. This reading apparatus is so constructed as to enable the person, who has the ruled design paper and the apparatus placed before him, to force the required punches from the plate in which they are usually put in ordinary reading machines, into such other plate as is commonly used to convey the punches to the blank card, in order that the selected punches may be forced through the substituted material in the ordinary manner. By means of this apparatus, the reading-in of the pattern may be effected by it in a less portion of time than by the modes which have hitherto been adopted; and the whole of the required punches may also be inserted into the punching plate (prior to its removal from the apparatus to the material which has to be perforated) by the reader depressing the keys of the apparatus with his fingers, in the manner of depressing the keys of a pianoforte or other keyed musical instrument. A number of bell crank levers, working upon axes suitably supported in a frame, are furnished at one end with keys, and at the other act upon needles, which are capable of being slid with ease through holes in the plates, to a sufficient distance to force the selected punches out of the first plate into the second one. The bell crank levers are kept in a position to be acted upon by the keys by means of spiral springs. Each needle in the machine has a small opening in it, through which the upper end of one of the bell cranked levers passes with a little freedom.

When a pattern has to be read by this machine from a ruled design paper, all that is required to be done by the reader, is to press down such keys of the apparatus as force out the punches corresponding with those marked or blank squares on the design paper, as indicate which warp threads have to be raised or which remain stationary; and when all the required punches for one card, or other material, have been forced into the punching plate, the plate, with the punches in it, has then to be removed to the blank card, or other material required to be pierced, and after the punches have been forced through it by the well-known machine used for that purpose, the plate and punches are withdrawn from the card, or other material, and placed again in the apparatus, when the punches are returned into the openings from which they were previously forced, in the ordinary manner, so that when it is required by the pattern, they may be again forced out.

Claims.

1. The employment in Jacquard machinery of an endless band of paper, gutta percha, or other suitable material, on which the pattern has been punctured when passed round, a cylinder attached to the batten.

2. The employment of the compound needles, which are actuated by the passage of the punctured paper over the revolving cylinder, and the mode of causing them to act upon some one or other of the horizontal needles of the lifting bars for the production of the pattern in the fabric.

3. The mode of bringing the needles into a position ready to be acted upon by the next succeeding portion of the pattern on the endless band, either by causing the revolving cylinder to fall so as to withdraw the endless band from contact with the needles, or by causing the case carrying the whole of the needles to slide up the batten a short distance to effect the same purposes.

4. The employment of needles of the form represented and described, which needles act on the horizontal ones, and so determine which of the warp threads should be raised and which left stationary.

5. The employment of a frame for supporting the needles, constructed as represented and before described.

6. The employment of the fixed curved perforated plate over which the endless pattern-band is caused to pass by the pitch wheels.

7. The combination and arrangement of means for lifting the needles out of the holes in the endless band when the design has been transmitted to the fabric, so as to allow of the passage of the next succeeding portion of the pattern over the curved plate and underneath the points of the needles.

8. The peculiar arrangement and combination of parts for transmitting motion to the improved Jacquard machinery.

9. The mode of producing the design upon a fresh endless band during the working of the Jacquard loom.

10. The application of an endless band of paper, gutta percha, or other suitable material, having the tune punched out therein, to the actuating of Jacquard machinery for the production of sounds in musical instruments.

11. The employment of an endless band of gutta percha, or any of the compounds thereof, having the pattern punched out upon it, for actuating the needles which act on the horizontal needles, and thereby determining which of the needles shall be raised and which left stationary.

And, lastly, I claim the arrangement and combination of the various parts constituting the reading apparatus before described when used to place the whole of the required punches in the punching plate before any of them are driven through the card or other substituted material.

David Newton, Macclesfield, merchant. *For certain improvements in the application of glass and glazed surfaces to nautical, architectural, and other similar purposes.* Patent dated August 7, 1849.

The "improvements" which constitute the present invention, are—

1. The application of glass terminals to the mast-heads and yard-arms of vessels for the purpose of repelling the electric fluid.

2. The construction of vanes or weathercocks of glass.

3. The employment of glass, suitably formed, for the internal and external decorations of buildings.

4. The substitution of glass keys for those of ebony in pianofortes, seraphines, &c., and the isolation of such instruments by means of glass legs.

5. The employment of glass letters, or numerals, or signs, for indicating purposes.

6. The heightening the effect when glass is employed for ornamental purposes, by quicking the glass, or by placing coloured tinfoil behind.

Mr. Newton makes no claim to any of his "improvements," and perhaps advisedly; for he has been completely anticipated by Miss Wallace in regard to the 3rd, 5th, and 6th heads (see vol. xlix., p. 224), and, by others whose names we cannot at the moment call to our recollection, with respect to the 1st, 2nd, and 4th.]

Samuel Thornton, Birmingham, merchant, and James Edward M'Connell,

Wolverton, Buckinghamshire, engineer. *For improvements in steam engines, and in the means of retarding engines and carriages on railways, and in connecting railway carriages or wagons together; also improvements in effecting a communication between one part of a railway train and another, by signals or otherwise.*

These improvements refer—

1. To an improved construction of piston.
2. To an arrangement of the chimney and blast pipe.
3. To the steam eduction passages.
4. To a mode of coupling.
5. The arrangement of buffing apparatus, which permits,
6. Of a mode of signalling, whereby
7. The breaks are made to act at the same time.

1. The packing rings of the piston are made with conical interior surfaces, against which the surfaces of other rings act, whose surfaces are also conical, but in a reverse direction. The insides of the interior rings are made with ledges, upon which rest elastic metal discs. Between these discs are placed spiral springs, which press them outwards, and, consequently, the wedge-like circumferences of the interior rings press against the interior ones of the packing rings, whereby the latter are kept in close contact with the sides of the cylinder.

2. In order to obtain increased draught without increase of height, the chimney of a locomotive engine is divided into several shafts, and the exhaust pipe into a corresponding number of blast pipes, one for each shaft.

3. The arrangement of eduction passages for facilitating the escape of steam, and thereby diminishing the back pressure on the piston, consists in making in each of the eduction passages an extra opening, over which works a valve, keyed at each end on the spindle of the ordinary steam valve. In the other side of the valve chamber, and exactly opposite the extra eduction ports, are openings through which, when the extra ports are alternately opened by the valves, the steam passes from the cylinder to the chimney.

4. The new mode of coupling has for its object to prevent the necessity of the workman getting in between the carriages (and thereby avoid the liability of his being injured while connecting them together) by an arrangement which permits of the coupling being effected from the side of the carriage. Through the centre of the coupling hook passes a rod, which is fitted with a handle at each end, while a coupling loop, having the hook between its ends, is keyed upon the rod, whereby it is made to take in or out of the hook of the preceding or succeeding carriage, as the case may be. The rod whereby the buffers are brought back, is actuated by mitre and bevel wheels driven from the side of the carriage.

5. The buffers, instead of being fixed underneath to the body of the carriage, are attached to the axles, or suspended in a frame attached to the axles, so that all the buffers are maintained in one horizontal right line.

6. These buffers are made hollow, and contain a chain reaching from the engine to the guard's carriage. Each end of the chain is wound round a pulley keyed upon the axle of a friction wheel, which can be brought down upon the periphery of one of the running wheels, whereby the friction wheel will revolve with the pulley on which the chain will be wound and the signal communicated.

7. The chain is made to act upon the breaks by means of toothed gearing, so that the operation of signalizing will also retard the progress of the train.

Claims.—1. The arrangement and construction of parts of a piston, in which the packing rings are adjusted by conical surfaces acted upon by elastic discs and spiral springs.

2. Dividing the chimney into several shafts, into which a corresponding number of steam pipes are made to exhaust.

3. The arrangement and construction of eduction valves, as described.

4. The coupling arrangement.

5. The mode of placing the buffers.

6. The arrangement and combination of apparatus for signalizing, which at the same time causes the breaks to be applied.

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal.*]

FOR AN IMPROVEMENT IN COMPOSITION FOR CURRYING LEATHER. *Isaac H. Hershey.*

To make and prepare the composition or stuff to be used on leather, instead of "dubbing," common rosin, gum asphaltine, common hard soap, tanners' oil, and stale urine, prepared as follows, are used:—

Half pound gum asphaltine; pulverise and mix the rosin and gum asphaltine, and put them into two gallons of good tanners' oil; then take one pound common hard soap, cut fine and put into the oil; then place the whole, as mixed, over a slow fire or heat, stirring occasionally until the soap is fully melted or dissolved; let stand awhile until pretty well settled, then pour off carefully, so that the sediment, if any, may remain in the vessel; while warm, add one

gallon stale urine, stir well, and when cool it is ready for use.

Claim.—The use of rosin, gum asphaltine, and hard soap, mixed and combined with oil and stale urine, for the purpose and use above stated.

FOR AN IMPROVEMENT IN ELEVATING WATER. *Daniel Winder.*

The object of this invention is to raise water by atmospheric pressure, above the height due to the pressure of one atmosphere, and the nature of the invention consists in connecting the lower part of an air-tight receiver, placed in the lower part of a well, with a pump placed more than thirty-two feet above the back of the water in the well, by means of a pipe provided with a two-way cock, that the pump may communicate with the receiver, or with the atmosphere, which pump communicates with another air-tight receiver above it, the top of the said upper receiver being connected with the top of the receiver in the well, by means of a pipe, and the lower part thereof by means of another pipe with the tank or tanks above it, into which the water is to be raised. The tube which connects the pump and lower receiver is exhausted, that the water from the lower receiver may be forced up by atmospheric pressure to the height due to the pressure of one atmosphere; the two-way cock is then turned, to close this communication and open the pipe to the atmosphere, for the purpose of drawing in air, and compressing it in the upper receiver, which being in connection with the top of the lower receiver, the elastic force of the air acts on the surface of the water in the lower receiver, to force it up to the height of the pump; so that, re-turning the two-way cock, to re-establish the communication between the pump and lower receiver, the water will be forced up into the pump, and thence transferred to the upper receiver, from which it will be forced up to the delivery pipe by the elastic force of the compressed air.

Claim.—The lower receiver placed in a well or other reservoir of water, in combination with the pump, placed more than thirty-two feet above the level of the water in the well or reservoir, and with the upper receiver; the pump and lower receiver being connected by means of a pipe, provided with a four-way cock, or other valve, so that the pump may connect with the receiver or the atmosphere, and the two receivers being connected by means of an air pump, that the air forced into the upper one by the pump may act on the surface of the water in the lower receiver, and force the water up to the pump, to a height greater than is due to the pressure of one atmosphere.

FOR AN IMPROVEMENT IN REGULATING THE HEIGHT OF WATER IN STEAM BOILERS. *Cadwallader Evans.*

Claim.—The application of a float within a separate cylinder or vessel connected above and below the water line of a steam boiler. The advantage of this arrangement is, that there will be no ebullition or foaming in the separate vessel as to agitate the float.

FOR AN IMPROVEMENT IN TELEGRAPHS. *Samuel Frew.*

Claim.—The use of a wire or other moveable medium, extended from one place to another, together with moveable dials, or other alterative contrivances, by which corresponding notations are made at the same time on the dials at the termini of the line, by means of words, figures, letters, signs, or emblems, written thereon at equal spaces, so that the moving of the wire or other medium, an allotted space, is made to produce accurate, intelligible, and coincident indications at the extremities, comprising under this principle the different modifications set forth in these specifications, by which combined movements of two or more media are made to result in definite indications of fact, locality, or idea, and the several systems by which the eye and ear are both notified of a call or other movement. Also the system by which one bell is made to serve for a number of rooms in an hotel or other establishment. Also the system by which light is produced and extinguished at any given point, by the movement of a wire or other medium.

FOR AN IMPROVEMENT IN FLOATING DRY DOCKS. *John S. Gilbert.*

Claims.—1. The method of connecting all the chambers, or separate compartments, on each side of the dock, with the pump well, by means of pipes or conductors, governed by cocks, gates, or valves, whereby all the separate compartments are made to act in concert or alone, or any number of them, in depressing or raising the dock; whether applied to docks with two side camels united together, or to side camels disconnected.

2. Dividing the camels into an upper and lower chamber, to hold, by means of a tight bulk-head.

3. Making and using gates on the sides of floating dry docks, in combination with the tanks or trunks.

NEW WAY TO CALIFORNIA.

We make the following extract from the advertizing columns of the *Times*:—

"CALIFORNIA.—The BALLOON RAILWAY, patented by J. Browne, Esq. J. B. requests that American and English capitalists would enter into communication with him as a previous step towards establishing a balloon railway from Washington, in the United States, to any particular spot in California. The distance, 3,000 miles, on favourable occasions, by hundreds of balloons, to be accomplished within three days. It is evident that it

would be an expensive and most formidable undertaking to construct a railway such as is now in use through a deserted and inhospitable country, over a mountainous and rocky tract of land. For such an undertaking, recourse must be had to newly-invented rails and new motive power—such alone can overcome the threatening difficulties. The balloon railway possesses powers and capabilities which other railways do not possess. The highest mountains and rivers offer it no impossible obstacles. It is free from those expensive operations of tunnelling, cuttings and levelling of mountains, and is far less dangerous than steam travelling. In point of expense, the balloon rail would not cost one-fiftieth part of the expense of the steam rails, and could be fabricated in much less time, at a rough guess, not giving more than four years to complete the line of 8,000 miles. The model may be seen and explained on application; but the inventor, for the present, reserves to himself his means of travelling to the west against a wind nearly south-west or north-west, likewise his means of landing the passengers safe and without inconvenience during a storm or violent gale of wind. This novel system of travelling is not proposed or offered as capable of superseding the old, in England, France, or Germany, but might be carried out to great advantage in the wide extensive dominions of the Emperor of Russia, in Africa, and in the East Indies.—30, Great Portland-street, Portland-place."

The reader may, perhaps, be induced to regard this as a hoax; but if he will refer to our subjoined Weekly List of New Patents, he will see that "J. Browne, Esq.," is in right sober and solemn earnest. The only apprehension which "J. Browne, Esq.," seems to have on the subject, is, that he may be anticipated by some forestalling knave (none whatever as to the practicability of his project); and so he has secured to himself by patent the sole privilege of conveying people through the air to the gold diggings! Has the gold-seeking mania produced anything more ridiculous than this? By the way, who could have thought that, by the term "*atmospheric* railways" (used in the title of the patent of "J. Browne, Esq.," see *infra*), he meant a railway laid down in the atmosphere itself—up far away among the clouds? Mighty clever this same "J. Browne, Esq.," must be, thus at once to disappoint all rational expectation, and to cheat the Crown by false suggestion out of an *impossible* monopoly. Her Majesty's broad domains include, no doubt, both the County of *Ayr* and the Isle of *Skye*; but there has been a common understanding (never disturbed till now) that no Crown Writ could run into these "extra-mural" districts.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.		No. in the Register.	Proprietors' Names.	Addresses.	Subject of Design.
Jan.	29	1756	Barwell and Co.	Northampton	Hemispherical heat-diffusing stove.
	"	1757	J. Robinson and Co. ...	Commercial-road East	Waistcoat.
Feb.	2	1758	Robert Adolphe Farmar........................	Mount-street, Lambeth...........	Case bottle stopper.
	"	1759	Joseph and Edmund Ratcliffe....................	Birmingham............................	Spring for opening and closing the covers of ink and other vessels.
	"	1760	Frederick Westley	Strand	Polychrest envelope.
	"	1761	Thomas Smith............	Prince's-street, Lambeth..........	Automatic or self-acting flushing apparatus.
	3	1762	F. and C. Hasell	Gloucester-street, Clerkenwell...	Paragon spring swivel.
	5	1763	Thomas Wharton	Birmingham...........................	Victoria ink-pot.
	6	1764	John Oliver York	Govent Garden	Instrument for measuring diameters.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Jean Adolphe Carteron, of Paris, France, now of the Haymarket, Middlesex, chemist, for certain improvements in dyeing. February 5; six months.

John Browne, late of Bond-street, but now of Great Portland-street, Middlesex, gentleman, for improvements in constructing and rigging vessels, and improvements in atmospheric and other railways. February 6; six months.

Edmund George Pinchbeck, of Fleet-street, London, for improvements in certain parts of steam engines; February 6; six months.

Thomas Snowdon, of Noel-street, Middlesex, engineer, for improvements in machinery for moulding and pressing artificial fuel and bricks. February 6; six months.

Joseph Harrison, of Blackburn, Lancaster, machine maker, and William Harrison, of the same place, cotton manufacturer, and John Oddie, of the same place, manager, for certain improvements in and applicable to looms for weaving. February 6; six months.

Henry Fisher, of Upholland, Lancaster, gentleman, for improvements in coke ovens, and in machinery and apparatus for working the same or connected therewith, and a mode or modes of applying certain portions of coke, or the residual products of coke, to heating and lighting. February 8; six months.

Lawrence Hill, Jun., of Motherwell Iron Works, near Hamilton, Lancashire, civil engineer, for improvements in the manufacture of iron, and in the machinery for producing the same. February 8; six months.

Henry Headley Parish, of Eaton-place, Middlesex, Esq., for improvements in safety and other lamps, and in gas burners. February 8; six months.

Richard Pannell Forlong, of Bristol, button manufacturer, for improvements in castors for furniture. February 8; six months.

William Willcocks Sleigh, of Stamford Brook House, Chiswick, Middlesex, doctor of medicine, for a means for preventing injury to persons and property from the sudden stoppage of railway carriages. February 8; six months.

James Webster, of Basford, Nottingham, engineer, for certain improvements in apparatus for manufacturing gas. February 8; six months.

John Taylor, of Parliament-street, Westminster, architect, for an improved mode of constructing and fencing walls. February 8; six months.

Joseph Barnes, of Church, Lancaster, for an im-

proved apparatus for bleaching, dying, cleaning, and steaming animal or vegetable fibrous substances, either in a raw or manufactured state. February 8; six months.

Robert Brown, of Sadlers'-wells, Middlesex, engineer, for improvements in machinery for perforating, sewing, stitching, pegging, and riveting. February 8; six months.

Thomas Charles Clarkson, of Bennet-street, Southwark, manufacturer, for improvements in the manufacture and application of leather, and of certain vegetable substances to be used in combination with leather, India rubber, canvas, silk, cotton, wool, and other fibrous substances. February 8; six months.

William Tooth, of Broad-street, Lambeth, engineer, for improvements in water-closets and in chimney-pieces, in machinery for the preparation of clays and other materials, and in the manufacture of earthenware articles. February 8; six months.

NOTICES TO CORRESPONDENTS.

A Brass Founder.—*There is a patent for the article referred to; date Jan. 5, 1848.*

"T. B. G."—*Quite new, we believe, and a fit subject for a patent.*

"B. B. N."—*Declined.*

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co. Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1332.] SATURDAY, FEBRUARY 17, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

MESSRS. HENLEY AND FOSTER'S PATENT IMPROVEMENTS IN ELECTRO-TELEGRAPHIC APPARATUS AND MACHINERY.

Fig. 3.

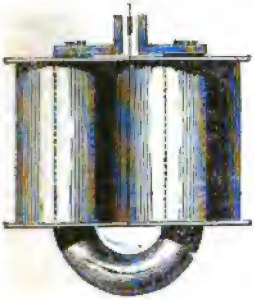


Fig. 1.

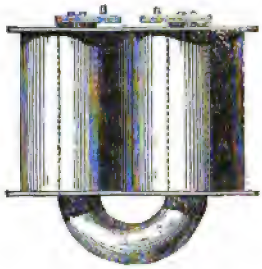


Fig. 3ª.

Fig. 1ª.

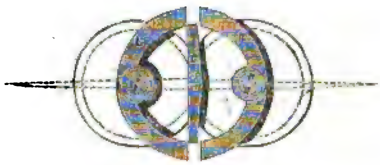


Fig. 4.

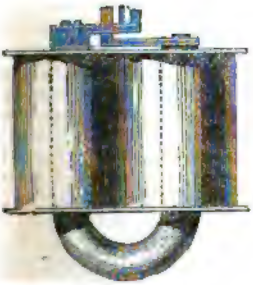


Fig. 2.

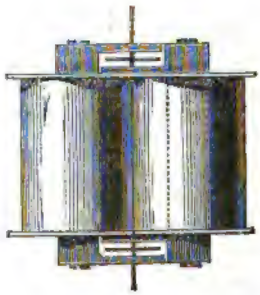


Fig. 2ᵇ.

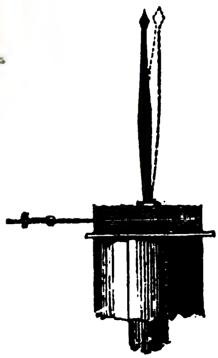


Fig. 4ª.

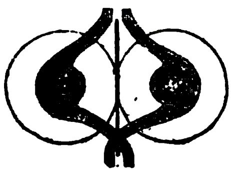
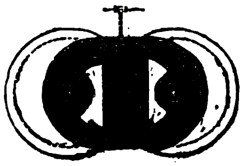


Fig. 2ª.



MESSRS. HENLEY AND FOSTER'S PATENT IMPROVEMENTS IN ELECTRO-TELEGRAPHIC APPARATUS AND MACHINERY.

(Patent dated August 10, 1848; Specification enrolled Jan, 10, 1849. Patentees—Wm. Thomas Henley, of Clerkenwell, Philosophical Instrument Maker, and David George Foster, of Clerkenwell, Metal Merchant.)

Specification.

Our invention consists, *Firstly*, in certain improved arrangements of electric apparatus, whereby a visible index hand or pointer is directly acted upon by a single magnet suspended within the sphere of influence of an electro or other magnet, having each of its extremities converted or resolved into two or more poles. Fig. 1 is a side elevation, and fig. 1^a, a plan of part of an apparatus embodying one of these improved arrangements. A is an electro magnet of the ordinary horse-shoe form, the extremities, *aa*, of which project a little way above the coil, and have affixed to each a segmental piece of iron, B, the two ends of which form two poles, so that each pole being thus parted into two, there are two pairs of poles opposed to each other. C is the magnet, which is suspended within the four poles of the electro magnet, and acts directly on the needle of the dial plate, so as to move it, according as the magnet is itself attracted and repelled. Another arrangement is shown in fig. 2 (side elevation), fig. 2^a (plan), and fig. 2^b (another side elevation). The pieces, BB, are of an elongated horse-shoe form, and overlap and underlay one another in the manner shown. Two other arrangements are shown in figs. 3 and 3^a, and in figs. 4 and 4^a, the parts peculiar to which will be readily understood by inspection of the drawings. In all these arrangements there is but one magnet employed, and that acts directly on the needle.

Secondly. Our invention consists in keeping the magnetic bar, needle, or pointer in one position for any length of time, or imparting to such bar, needle, or pointer any number of distinct deflections or movements, by means of the current or currents derived from magneto electricity, and also in making use of the residual magnetism to act upon the needle on its return to its stationary position, instead of the force of gravity; that is to say, in moving the needle in one direction by the induced current, and bringing it back to its stationary position by the action of the reversed inductive current, whereby the motions of the needles are increased in rapidity, and rendered much more marked and distinct than heretofore.

Thirdly. Our invention consists in certain improved arrangements of the magneto-electro apparatus used in electric telegraphs, whereby two distinct currents may be derived from the same magnet, and the reversed current can be made of equal intensity with the primary induced current, and single or double currents may be sent, as required, through any required number of instruments at different stations.

The details of these improved arrangements are exhibited in figs. 6, 6^a, 6^b. A, fig. 6, is an ordinary horse-shoe magnet, fixed in any convenient position; BB are two coils of wire, which envelope the soft iron pieces, *a′a′*, and are placed near to, but not in actual contact with, the two poles of the magnet. Each of these coils is centred on a spring lever, C, so that when the button, C^2, on the top of that lever, is pressed upon by the hand of the operator, or by other mechanical means, the coil is moved away from the pole of the magnet, while on the removal of the pressure, the lever and coil return to their original positions. Beneath and outside of the two coils, BB, there is fixed a piece of soft iron, C^3, which acts as an armature to the magnet, A, so that the motions of the coils take place from between the poles and the armature. Figs. 7 and 7^a represent another position in which a coil may be placed in regard to the pole or magnet. In this case, the coil is suspended between the two poles, so as to be near to, but not in actual contact with them, and is moved from a centre, *d*, in an arc of a circle, to either side, according as the current is required to flow in one direction or the other. The armature is provided, as usual, with short circuit and reversing springs, which, during its motion, complete or destroy the metallic contacts; but these springs being well-known appendages to electric telegraphic apparatus, need not be here particularly described. Figs. 8 and 8^a show a form of arrangement which will give the opposite currents of equal power. AA are the poles of any magnet; CC, the coils of wire which cover the armature, and are so placed that, when in motion, one pole of the magnet is not released from its opposition to the armature until the other just touches it.

By this means the two opposite currents have an equality of power, and the needle or other suspended magnetic body is acted upon in both directions by opposite and equal forces.

Fourthly. Our invention consists in the improved apportionment of the signs or symbols used in electric telegraphs. [The

Fig. 7a.

Fig. 7.

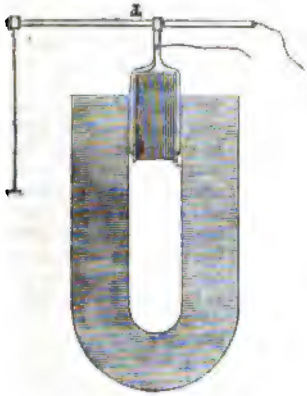
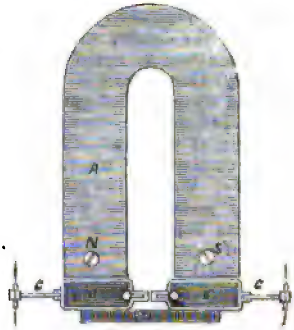


Fig. 6.



6a

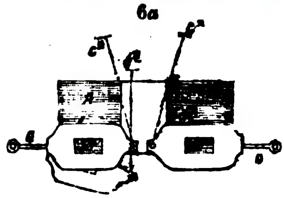


Fig. 8a.

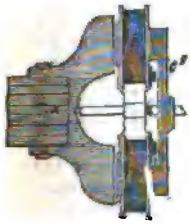
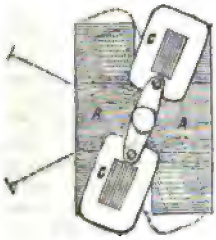


Fig. 8.



6b

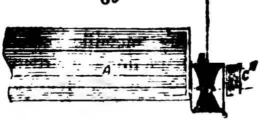


Fig. 10.

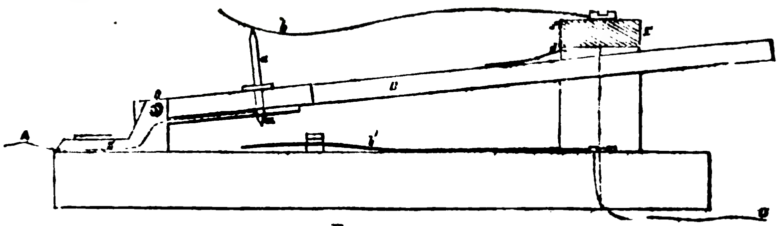
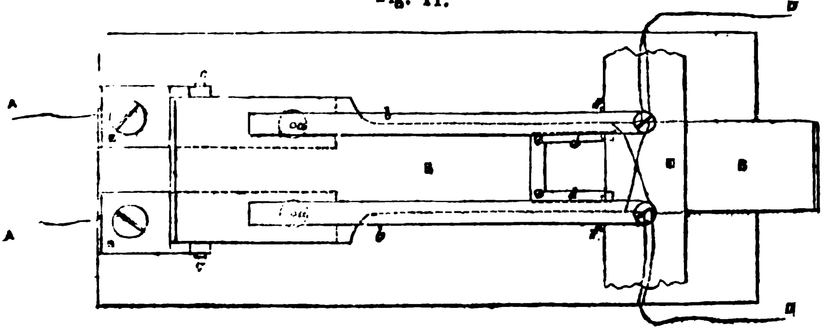


Fig. 11.



object of this new apportionment is to reduce the number of movements requisite, and it seems very successfully carried out. We pass over the details, which would occupy more space than we can afford to them.]

Fifthly. Our invention consists of an improved compound of gutta percha, suitable for the insulation, covering, and exterior protection of wire and other metallic substances employed to transmit currents of electricity. We mix the gutta percha nearly in equal portions, by weight, with sand which has been ground or pounded to a degree of fineness exceeding that of the finest natural sand, or with the siftings of glass paper manufactories, or glass fragments and particles of any sort, reduced to a similar degree of fineness, and this either by mixing the pulverized sand or glass with the gutta percha in a state of solution, or while in a plastic state.

Sixthly. Our invention consists in the employment of a current reverser of a peculiar construction, whereby we are enabled to dispense with the use of magneto-apparatuses for the purpose of deriving currents of electricity in the manner before described, and to substitute in lieu thereof voltaic batteries such as are commonly in use for the purpose of transmitting currents of electricity along metallic conductors, such reverser completing the circuit twice during its motion, by the transmission of a reversed current, in the manner of the magneto-machines.

Figs. 10 and 11 represent two views of this reverser. B is a lever or key, which is actuated by hand, and centred upon two detached pins, *cc*, which are connected, as shown, with the two poles of the battery; *aa* are two upright pins, which are also in metallic contact with the pieces of metal, *zz*, and therefore become the two poles of the battery; and $b\ b^1$ are two sets of springs, which press upon the pins, *aa*, and are attached to the line wire circuit. When the lever or key, B, is at rest, both sets of springs remain off the battery circuit. But when the lever is pressed down, the pins, *aa*, are brought into contact with the lower springs, and the upper springs fall at the same time upon the completing pieces, *ff*, which permit the circuit to pass during the return of the lever or key to its former position. The circuit is broken by the bottom pairs of springs, and completed in turn by the upper pair pressing the pins, *aa*; but this is effected in a reversed direction, in consequence of the two pairs of springs being connected crosswise, as indicated in fig. 11. On the final adjustment of the reverser, the current is again cut off, the circuit being broken between the springs and the competing pieces, *ff*.

Seventhly. Our invention consists in the employment, in manner following, of currents of electricity to regulate and govern the motions of time-keepers, whether the same be influenced by a current from a distant station or otherwise. We make use for this purpose of the currents of either magneto or voltaic electricity; but obtained in the latter case without the aid of soft iron from two hollow coils of insulated wire affixed to the pendulum of the regulator, and surrounding the poles of two permanent horse-shoe magnets, which coils vibrate in the direction of their length alternately, off one pole on to the other, a current being induced at each vibration, but in opposite directions. Fig. 13 is a side view of the magnets and coils; and fig. 14 an end view, with one magnet removed. A A, are two permanent horse-shoe magnets; B, is an oscillating case containing two coils of fine insulated wire placed parallel to each other. The case oscillates in an arc which always includes within it the four poles of the magnets, and each coil, as it oscillates along with the case, covers alternately the similar poles of each magnet, but without touching them. The two free extremities, *m* and *n*, of the coil, are carried to some suitable conductors for conveying the current incident upon the vibration of the pendulum or coils over the poles of the magnets, which current flows in reversed directions, as the motion takes place from one side or the other. C, is the necessary adjustment for the regulation of the pendulum.

Eighthly. Our invention consists in a mode of giving motion to a train of wheels, with or without an auxiliary propelling power, for the purpose of showing correct time, by means of either voltaic or magneto electricity transmitted from a standard or primary clock. Fig. 15 represents the back of a time-piece, which may go, by means of a spring, any required time. The escape wheel is shown at A; *b b*, are the pallets with their arbor, *c*, on the end of which is fixed a light brass arm, D. At A^2 is seen an electro magnet with the soft iron segments on the poles, as before explained, and this with the axis, *l*, which carries the magnetized steel, is placed vertically. On the axis is fixed a brass fork, *d*, which embraces the arm, D, but is left sufficiently wide to have considerable motion either way without touching the arm, and so acquires sufficient momentum to move the pallets easily. Or the spring and fusee may be taken away, and the motion produced by the force of the current alone. When the current passes from the regulator, the piece of steel, *m*, is deflected, and moving the arm, liberates the

escape-wheel half a tooth, in which position it is kept by the residual magnetism until the current passes in the opposite direction, whereupon it is deflected to the other side, allowing the wheel to move another half tooth, and so on; this motion showing seconds, or half seconds, on the dial. *Fig.* 16 shows part of a time-keeper moved by voltaic electricity every half minute, having a maintaining power; *a*, is the winch barrel; *b*, the second; and *c*, the wheel on which the hand is fixed. For the sake of dispensing with the dial work, there is but one hand, but the dial is so engraved as to show the time as well with one as with two. We also propose to apply this description of dial to ordinary clocks. The escape-wheel, shown at *d*, revolves once in an hour, having sixty teeth, which are liberated by the forks, *c* and *f*, according as these are moved by the action of the steel bar, *m*, and magnet, A^2. The current is transmitted by a revers-

Fig. 15. Fig. 13. Fig. 14.

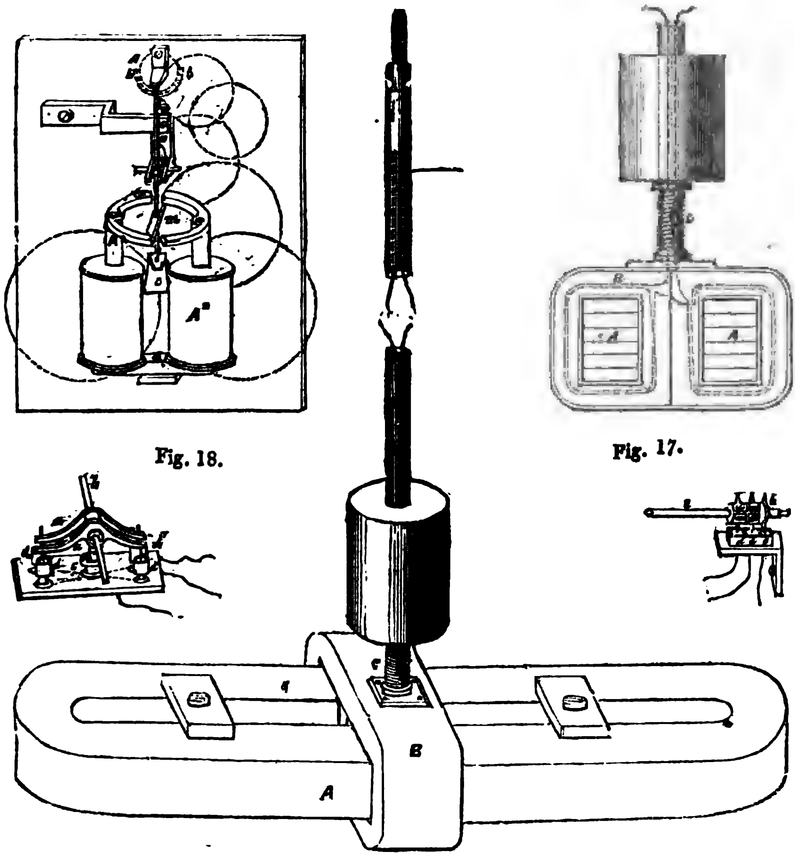
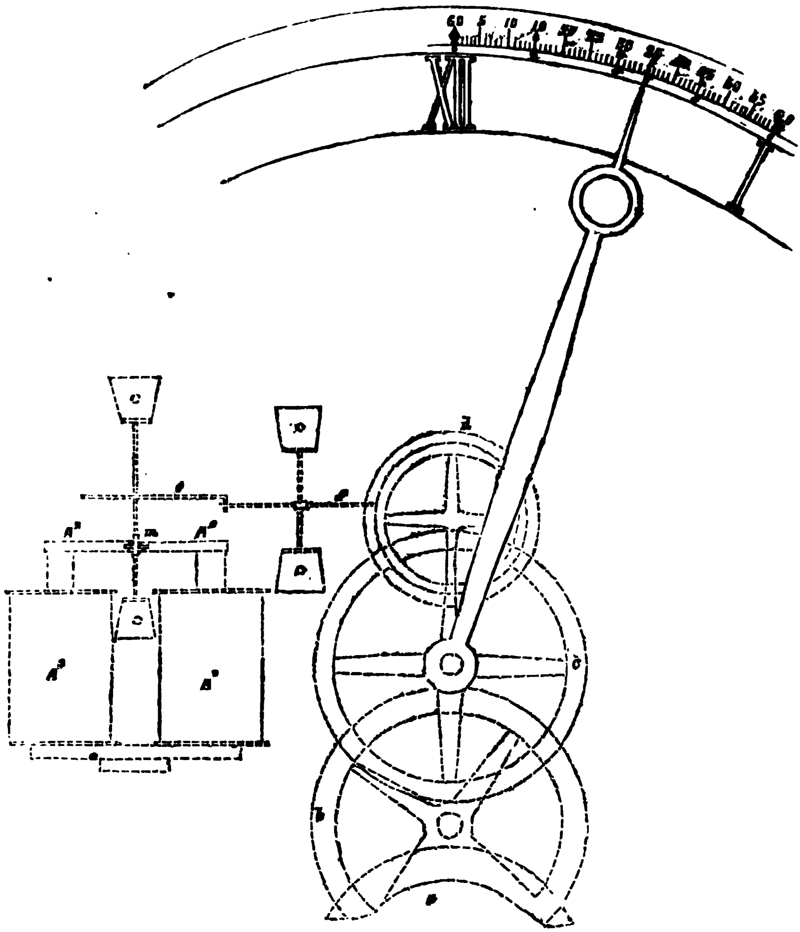


Fig. 18. Fig. 17.

ing instrument, shown in fig. 17, which is placed on the escape-wheel arbor of the regulator, and is formed of ebony or some other non-conducting material. This reverser has four segments of brass, *a a*, pinned on the circumference, two connected with the arbor, as shown by the screw heads, and the other two with the metal flange, *b*, dipping in the outer cup of mercury, *c*. Four platina points are screwed into the segments, *a a*, and also dip into mercury troughs, *d d*. One pole of the battery is connected with the arbor, *e*, and the other with the metal flange, *b*, by means of the mercury trough, *c*. As the other troughs with the wires lead to the clocks, the current is thus

reversed twice every revolution. Fig. 18 represents another current reverser, which may be placed on the pallet arbor for the purpose of transmitting the current every half second, or second, according to the length of the pendulum, similar to the magneto current before mentioned. Of the two beams, *a a*, one is in connection with the arbor, *b*, the other with the centre mercury cup, *c*, by means of the wire, *e*, dipping into it, which never leaves the mercury; the beams, *a a*, are insulated from each other, and have at each end a platina wire for dipping into the cups, *d d*, *d' d'*, which are connected in pairs by wires passing underneath, as shown by the dotted line in the engraving. The battery is connected, as in the former case, with the arbor, *b*, and the mercury cup, *c*. The platina wires dip alternately into the right and left-hand pairs of cups, according to the vibration of the pallet arbor in the usual manner. The same arrangement may be also applied to cause a secondary current to flow in opposite directions for the working of turret and other clocks. The apparatus for setting the secondary battery or current, before mentioned in action, consists of one of the electro-magnets, before mentioned, with its soft iron segments and magnetised bar, on the

Fig. 16.



axis of which last is placed a piece of apparatus on a small scale, similar to that shown in fig. 18. The magnet and axis in this case must be horizontal.

Claims.—1. We claim in respect to electric telegraphs, and to all machines or machinery, to the moving of which electricity is or may be applied, the different arrangements of apparatus described under the first head of this specification, in so far as respects the division of each pole of the magnet into two or more poles, and the direct action on the index-hand or pointer, or other recipient of the magnetic influence.

2. We claim the mode of causing the index-hand or pointer to be permanently deflected (that is, for any length of time required) in one direction, and bringing it back by the reversed current to its original stationary position, and keeping it there, as before described.

3. We claim the three several magneto-electric apparatus described under the third head of this specification, in so far as regards the peculiar arrangements and combinations, whereby two distinct currents are obtained from the same magnet, the reversed current is obtained of equal intensity with the primarily induced current, and either single or double currents may be sent as required through any number of instruments at different stations.

4. We claim the improved system of visible symbols suitable for electric telegraphs, before described and exemplified.

5. We claim the employment in electric telegraphs, and in all other machines and machinery to the moving of which electricity is applied, of the peculiar compound of gutta percha, before described, for purposes of insulation and protection.

6. We claim the improved current reverser, before described, in so far as respects the effecting by a single depression of the lever or key, the completing, reversing, and breaking of the electric current.

7. We claim the application of currents of magneto-electricity to regulate the motion of time-keepers in the peculiar manner described under the seventh head of this specification; that is to say in so far as regards the obtaining of the currents from the inductive action of permanent magnets and coils of insulated wire without the aid of soft iron.

And, 8. We claim the application to the regulating of time-keepers of currents of electricity (whether magneto or voltaic) transmitted from a primary or standard clock by the improved apparatuses and instruments, and by the peculiar modes before described, that is to say in so far as regards the alternate transmission of the current in opposite directions, and the different mechanical arrangements whereby that is effected.

SMITH'S YIELDING SEA BARRIERS.

Sir,—The principle of Mr. Smith's sea barriers, noticed in the Magazine of last week, appears to me to be very valuable, and distinguishable from all of the yielding class which have preceded it in this important particular, that it combines fixity of position with perfect freedom of oscillation. I do not conceive that the gangway is at all a necessary part of the invention, as the breakwater, without it, is a perfect structure. To this latter portion therefore will I confine a few observations, which I am desirous of submitting to your readers on the subject. In defining the force of impact, Professor Whewell observes in his Mechanics of Engineering, page 195, that "when one body strikes or impinges upon another the velocity of one or both is suddenly altered." And again, in the same page: "In cases of impact the effect is produced by a sudden and brief pressure of great intensity; the length of time occupied by the pressure and the law according to which the variation goes on during this time, will depend upon the material of the body and other circumstances. When one body impinges upon another, so that the two go on together after impact, we may conceive the pressure which takes place between the two, to vary steadily till it attains its ultimate value, and the bodies go on without further mutual action, is of a nature of a series of vibrations constantly diminishing, and at last vanishing."

Impact is, in short, nothing more than the application of a dynamic force through an insensibly small space. A weight of 100 lbs. falling from a height of 10 feet gives a dynamic unit of 1000, and is equal to 1000 lbs. acting through the space of one foot; to 2000 through 6 inches, to 12,000 lbs. through 1 inch, or to 120,000 lbs. through the $\frac{1}{10}$th part of an inch. It therefore follows that if the 100 lbs. fell upon a spring and compressed it through the space of a foot, it would register a maximum pressure of 2000 lbs., and if the weight fell upon a large stone, or upon an iron anvil and compressed the surface of the material

through the $\frac{1}{100}$th part of an inch, it would give a blow at the instant of greatest compression of 240,000 lbs. A body drifting before a wave receives no injury, however rough the waves may be. Mr. Smith applies this principle by allowing the piles of his breakwater a freedom to move in the direction of the force of the wave round a fixed centre, the piles being moored by braces rendered elastic by the application of the counterbalance weight C.

In as far as the investigation is concerned, diagrams of one section will be sufficient. Therefore let AB, fig. 1, be the pile fixed to the ground by the screw at B, and suppose it to be free to move round a joint at B, and describe the arc, *Aa*. Let DC and CE, be the iron braces coupled at C, and W a counterbalance weight attached to the joint C.

PL > WL′ cot ϕ, but as the pile moves over, the weight W rises, the rods DC and CE become straighter, and the tension increases, until at length the opposing forces become equal; for the moment, the whole is in equilibrium; but the force of the wave being expended in raising the weight W, the tension in the rod quickly preponderates and brings back the framework to its original position again.

Thus, suppose the waves to have driven the pile AB into the position indicated by fig. 2, then DC and CE would be the position of the mooring braces, and the work done by the sea in moving the pile into the position represented, is to lift the weight W, through the vertical space CI = Wl' sin CEI, and when this becomes equal to the whole dynamic force, that is, of the wave, the strain in the moorings preponderates and gravity brings the frame into its position again.

Fig. 1.

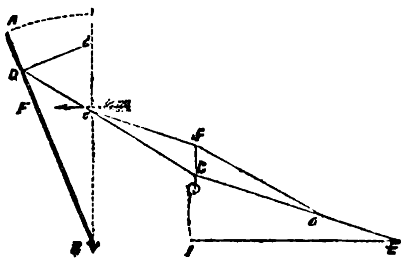
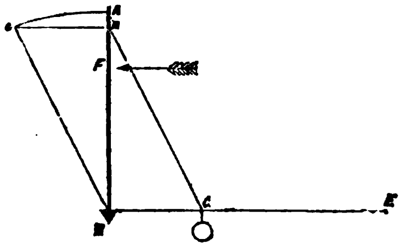


Fig. 2.



The effect of a blow can never be greater than the resistance opposed to it. The resistance which each section of Mr. Smith's breakwater offers to the sea is the tension on the rod, DC, which is the resultant of the weight W, acting at the joint C. Hence, put P = the force of the sea acting upon the pile at the centre of pressure, F; weight = WDB = L, FB = L′. Let the length of the rod DC = l, and that of the rod CE = l'; and let the angle DCB = ϕ. Now the effect of the force P to turn the pile round the point B is = PL, and the tension in the rod DC = $\frac{W}{\sin\phi}$; or the effect at right angles to the pile in the line Dd is W cot ϕ; this referred to the point B is = WL cot ϕ, which is the effective resistance the moorings offer to the motion of the pile when the sea is rough. In all probability

If it be required to construct the equation of the forces when the whole is in equilibrium: From the point C, draw the perpendicular line, cf, of any convenient length, and from the point f, draw cf, parallel to C E. Then cf : the weight W : : fc : the tension in CE : : fe : tension in DC. Now, according to a well known proposition in plain triangles.

$$fe = \frac{\sin fCe \,.\, fC}{\sin feC},$$

or tension in

$$DC = \frac{W \sin fCe}{\sin feC},$$

which is equivalent to a right-angled action, and in the direction

$$Dd = \frac{W \sin fCe \sin BDC}{\sin feC}.$$

Which, when referred to the point B, becomes

$$= \frac{W \sin Cfe \sin BDC}{\sin feC'} L,$$

which should be equal to P′L′. When P′ is the force of the sea and the pile is in its inclined position.

The above equations express in general terms the mutual action of the sea and breakwater: those who are conversant with the calculus of sines, will find no difficulty in reducing it to a numerical value. If it be required to obtain a more specific value of the force of the sea, it will be necessary to find the value of P something after the manner of the formula expressed in my letter, page 533.

I am, Sir, yours, &c.

WILLIAM DREDGE.

Norfolk-street, February 8, 1849.

REMARKS ON SERIES, AND ON THE METHOD OF INDETERMINATE COEFFICIENTS. BY PROFESSOR YOUNG, BELFAST.

The subject of series is one of considerable importance in most of the advanced inquiries of analysis: in some of these they enable us to compute, with comparative ease, the approximate values of finite expressions, which, in their undeveloped form, are beyond the reach of direct calculation, because the numerical labour would be intolerably great. In other cases, series are resorted to in order to effect the solution of problems which resist solution in finite forms.

In both these applications of series, there is an important condition to be observed, in order to prevent their introduction from being not only useless, but the source of serious error;—the series, when extended to infinity, must always be *convergent*. This condition is strangely overlooked, and not unfrequently by the most practised algebraists; and problems are thus apparently solved, and the powers of algebra apparently extended, when, in fact, nothing is really accomplished but an ingenious concealment of error;—in all cases, of course, unintentional. Books on analysis unfortunately furnish but too many illustrations of this; it will suffice here to advert to a single instance. A good deal in the way of commendation has been said, and continues to be said, in reference to a process investigated by the late Mr. Murphy for finding the roots of equations in general by series: his rule is this:—

"To find the series for the least root of the equation $\phi(x)=0$, divide the equation by x, and take the Napierian logarithm of the quotient which arises; then the coefficient of

$$\frac{1}{x},$$

with its sign changed, is the series which expresses the least root required."

Now, although this truth may be of sufficient theoretical interest to deserve a passing notice, yet, as a practical rule, it is of little or no use, and by no means merits the encomiums which have been passed upon it. It is, indeed, rather calculated to mislead; and, I have no doubt, has misled many; for we have no means of determining the complete coefficient of

$$\frac{1}{x}$$

in the logarithmic development alluded to; and the serial part of that coefficient, which, alone, is always taken, and which, alone, the rule seems to recognize, is only a portion of the true co-efficient; and therefore must always involve error, except when the coefficients of the equation are so related to each other as to cause the portion omitted to become evanescent. This will be at once seen by a reference to the simple case which Peacock* has chosen to illustrate the method, viz., the quadratic

$$x^2+ax+b=0.$$

In this case the coefficient of

$$\frac{1}{x}$$

is stated to be

$$\frac{b}{a}+\frac{b^2}{a^3}+\frac{4}{2}\frac{b^3}{a^5}+\frac{6\cdot5}{2\cdot3}\frac{b^4}{a^7}+\frac{8\cdot7\cdot6}{2\cdot3\cdot4}\frac{b^5}{a^9}+\&c.,$$

which, if a be equal to b, is evidently infinite, as it also is in innumerable other instances. If we could stop at any term we please, and then assign the value of the supplementary quantity under the "&c.," we should attain accuracy; but this cannot be done. It is true, that from our previously knowing the finite expression for the root sought, namely,

$$-\frac{a}{2}+\sqrt{\left(\frac{a^2}{4}-b^2\right)},$$

we can test the correctness of the preceding expression, as far as the *series* is concerned; but the *complete* expres-

---

* Reports of the Third Meeting of the British Association, pp. 259, 350.

sion involves the series, and something more; and for the determination of *this*, we are furnished with no clue. If the series alone could suggest the *remainder*, the method in question would accomplish the objeet proposed, but this is not the case, even in an equation so simple as a quadratic; it is needless, therefore, to examine into its defects in equations of the higher degrees.

What is called by writers the *sum* of an infinite series, is in general the finite expression which generates the series, together with the "something more" already adverted to; and, as before observed, except in those cases where this additional quantity, or *remainder*, becomes evanescent, this sum is always erroneous. If we turn to the subject of recurring series, in any book on algebra, we shall invariably find all the expressions for the sums of such series to infinity to be affected with this error. And not only is the young student thus betrayed into false conclusions, but the most experienced algebraists are often led into very serious mistakes. Thus, in the profound and masterly "Report" already referred to, the recurring series,

$$1-3+6-10+15-21+\&c.,$$

is said to be $\frac{1}{8}$. This false expression for the sum in the work quoted, is deduced from Euler's Differential Theorem; which as I have elsewhere shown, involves the same error as that adverted to above.*

A correct and easy method of summing, to m terms, the class of series to which this example belongs, is suggested by Professor Graves's paper in the *Philosophical Magazine* for January last; or by a paper in the current Number (Feb., 1849,) of that Journal; the sum of any such series to *infinity*, is evidently itself infinite.

From either of the papers referred to we easily deduce that the sum of terms of the general series

$$1-nx+\frac{n(n+1)}{1\cdot 2}x^2-\&c.\ldots\ldots\ldots\ldots A_n(-x)^{m-1}$$

where A_n is put for

$$\frac{n(n+1)\ldots(n+m-2)}{1\cdot 2\ldots(m-1)},$$

is

$$\frac{1}{(1+x)^n}-(A_nR_1+A_{n-1}R_2+A_{n-2}R_3+\ldots A_1R_n)$$

in which

$$R_1=\frac{(-x)^m}{1+x},\ R_2=\frac{(-x)^m}{(1+x)^2},\ R^3=\frac{(-x)^m}{(1+x)^3},\ \&c.$$

for the several cases which come under the above general series we could get correct sums, to m terms, even by the method of recurring series: this arises from the circumstance that the same error enters twice in that process, and by its opposing influences neutralises itself.

The example just given suggests a point of further interest to the student: suppose we change the sign of x, and seek the sum of m terms of the particular series

$$1+2+3+4+\&c.$$

From the above general form we have

$$1+2x+3x^2+4x^3+\&c.$$

$$=\frac{1}{(1-x)^2}-\frac{mx^m}{1-x}-\frac{x^m}{(1-x)^2},$$

For simplicity, put $m=3$, as well as $x=1$; it is propable that a learner might then write

$$1+2+3=\frac{1}{(1-1)^2}-\frac{3}{1-1}-\frac{1}{(1-1)^2}=-\frac{3}{1-1}=-\infty.$$

which erroneous conclusion would arise from confounding the *isolated zero*, in the denominators of the fractions, with the *zero of continuity;* an error which, I am glad to see from his paper in the last Number of this Journal (p. 104), so able an analyst as Mr. Cockle, distinctly deprecates. Restoring then the general symbol x, we have, in the case of $m=3$,

$$1+2+3=\frac{1}{(1-x)^2}-3\frac{x^3}{1-x}-\frac{x^3}{(1-x)^2}=\frac{3x^4-4x^3+1}{(1-x)^2}=12,\text{ when }x=1,$$

* Proceedings of the Royal Irish Academy, Jan. 1845.

as we find by the common method of vanishing fractions.

It is obvious that we may avail ourselves of the formula for the summation of m terms of a series proceeding according to powers of x, with figurate numbers for their coefficients, to obtain the summation of a great variety of other forms: a single instance will sufficiently illustrate my meaning.

If we omit the terms involving R_1, R_2, &c., we shall, have for the development of $(1+x)(1-x)^{-n}$, the series.

$$\begin{array}{r|l|l|l} 1+n & x+\frac{n(n+1)}{2} & x^2+\ \ldots\ldots\ A_n & x^{m-1} \\ 1 & +\quad n & + & +\ A_n x^m \end{array}$$

and, consequently, restoring the terms omitted,

$$1+(n+1)\,x+\frac{n(n+3)}{2}x^2+\frac{n(n+1)(n+5)}{2\cdot 3}x^3+\&c.,$$

to m terms, will be equal to the expression,

$$(1+x)\left\{\frac{1}{(1-x)^n}-A_n R_1-A_{n-1}R_2-\ldots\ldots-A_1 R_n\right\}-A_n x^m.$$

If we suppose $n=2$, we shall thus have the sum of the series

$$1+3x+5x^2+7x^3+\&c.,$$

to m terms: if we make $n=3$, we shall have the sum of the series.

$$1^2+2^2x+3^2x^2+4^2x^3+\&c.,$$

and so on

It may not perhaps be irrelevant to make here a remark that should have been appended to my short paper on indeterminate coefficients, at p. 83. In summing series by this method, the uniform practice is to change in the nth term of the series, the n into $n+1$; and to make a like change in the assumed expression for the sum: and then to subtract, from this latter, its original value. It would be better, because somewhat easier and shorter, to leave the nth term of the series unchanged; to change n into $n-1$ in the assumed expression, to subtract the changed form from the original, and to equate the remainder with the nth term of the series; the trouble of changing this nth terms is thus avoided, and the unknown coefficients are as easily determined as upon the old plan.

I have only further to add, that I have not had an opportunity of consulting Murphy's original paper; and have taken the version of his method from subsequent writers. Of Murphy's superior analytical talents, I entertain the same estimate which every one entertains who can form an opinion of them; and I have here ventured to comment upon his rule for solving equations, solely for the purpose of showing to the young algebraist the necessity for caution in dealing with series.

Belfast, February 7, 1849.

A LEARNED LORD *in re* HARDY'S PATENT AXLE.

*The Right Honourable Lord B———m to G——e H——n, Esq. M.P.**

Bellamy's, 3½ p.m.

Dear Mr. H——n,—I am just come from the Privy Council, where we have been all day occupied with the application of one Hardy, for a prolongation of a patent which he obtained some years ago for a railway carriage axle. The superiority of this axle over every other heard of, before or since, was demonstrated beyond all possibility of doubt. Nothing could be more entirely satisfactory than the experiments exhibited in the presence of the Council. Prodigious weights were laid on the axle without its evincing the least symptoms of fracture. (I proposed to C———l to add his weight, and I won't say what might then have been the case; but he wouldn't—sour and surly, as usual. As it was, the result was as I tell you.) Shocks, too, of the most startling suddenness and crushing magnitude were given to carriages fitted with this axle, but

* How we came by this letter it is not worth while explaining, since all that the reader is likely to care about is its genuineness; and of this no one who reads it can be in any doubt.

no breaking—no, nothing of the sort. Bend the axle did, into a semicircular shape, but it still held fast hold of the wheels, as if it defied all the powers of earth to sunder them. I heard C———l whisper that it would be better it should break than do that, since the collapse of the axles would draw the wheels off the rails. But "plain John," as you will readily see, knows nothing of mechanics, and very prudently leaves these things to me—"the oldest mathematician" (alack!) alive. What more can you possibly want in an axle, than that it won't break, do what you will? Much struck with this peculiar and extraordinary feature in Hardy's invention, I suggested (aside) to my excellent friend, H———ll (M——— D———t), that his client should—reversing the celebrated words of the late Lord Clive—take for his motto these: "*Me flectas non frangas.*" (You don't know Latin, H———; but the same learned friend who translated for your good lady the words "*bijouterie*" and "*vertù*" (into *bigotry* and *virtue*,) will tell you what I mean.) However, to come back, dear Mr. H———, to the purpose of my now writing you; it was proved in evidence before us, that admirable—all-sufficient — everything-to-be-desired—as this axle is, you railway gentlemen won't adopt it, and that this ingenious man (Hardy), who lacks but your permission to be one of the greatest possible benefactors to his country, is a loser—a sort of fool *quoad hoc*—for his pains. Mr. H——, Mr. H——, this is very, very wrong. I am shocked to think that there should exist anywhere such stolid—such iron—such granite-hearted indifference to the interests of the public and the claims of humanity. Do you know, Sir, to what pains and penalties you gentlemen of the railways expose yourselves? I will tell you. The punishment due to MANSLAUGHTER for every life destroyed by, or through, or on account of, or consequent upon broken axles. A heavy pecuniary solatium for every limb lost, or other bodily injury caused by your preposterous preference of the unsafe for the safe—the bad for the good—the life-destroying for the life-preserving—the dagger for the shield. Knowing well, as you all do, that there has been an axle invented which nothing can break, you wickedly persist in using axles of a sort which are breaking every day, and causing a lamentable loss of life and amount of personal injury to her Majesty's liege subjects. The *animus injuriandi* is clear — as clear as anything can be to the optics of men not utterly blinded by the grossest ignorance or most revolting avarice. If coroners and coroners' juries would only be guided by me, the first inquiry in all future inquests on the bodies of persons killed by the breaking of axles should be—Was it a Hardy's axle? And if the answer should happen to be in the negative, a verdict ought at once to be returned of "Manslaughter" against the whole body of Directors of the particular line on which the accident occurred—even though, my dear Mr. H———, the chief of these directors should be the "Railway King" himself. It just occurs to me, however, that this is a view of the matter which I may better dispose of from MY PLACE IN THE LORDS; there I may ring a peal which shall be heard from one end of the kingdom to the other. And so, dear Mr. H———, in haste to catch an opportunity before the House rises,* I remain,

Dear Mr. H——— (*in re* Hardy),

Your affectionate friend,

V——x and B——-M.

HYDROSTAIC ENGINE.

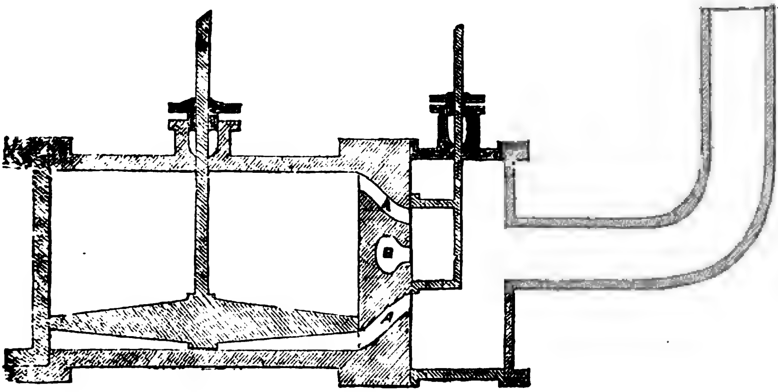
Sir,—In your Journal, some few weeks ago, there was an account of a "Hydrostatic Pressure Engine." I was much surprised to see so imperfect a method proposed whilst we have such a beautiful model in the steam engine to copy from.

It was there proposed that a column of water should act on the piston from beneath, and that when the piston had arrived at the top of the cylinder, the positions of the valve should be changed so as to form an outlet or waste pipe for the escape of the water contained in the cylinder. So far good; but the inventor, aware, no doubt, of the effect of the pressure of the atmosphere upon the waste pipe, proceeds very absurdly to overcome this difficulty by continuing the outlet or waste pipe downwards a distance of 30 or 33 feet. Why, the only effect of the 33 feet of prolongation would be to get rid altogether of the water contained in the cylinder.

I have a plan of my own for a water engine (to supersede water-wheels), which I believe to be of a more reasonable sort. I propose taking the cylinder

* For what the noble, learned, and eccentric author of this letter did say on this subject in the House, see daily papers of the 15th February.

of a steam engine as a model, with its slide valve, port holes, and waste pipe; the position of the slide valve to be changed suddenly when the piston arrives at either the bottom or top of the cylinder; the port holes for admission of water to be made much larger than those for a steam cylinder, and likewise the waste pipe. In the annexed figure, A A are the port holes for admission of water, and B the waste pipe. It will be seen from the sketch that the water not only exerts a pressure beneath the piston (as in the "hydrostatic pressure engine"), but also above the piston; therefore doing away with the necessity of a pipe 33 feet deep.



I have made the following rough calculation of the results of an overshot water-wheel and a hydrostatic engine on my plan, assigning all minute fractions to the side of the water-wheel. The comparison was made between an overshot water-wheel 18 feet in diameter with 20 feet fall from above, and founded on the data furnished by Brewster's edition of "Ferguson's Mechanics." I found the wheel would equal about 11⅝ horses power. Then calculating the power of a hydrostatic engine that should expend the same quantity of water in making one revolution as the water-wheel would do in one revolution, I find that the hydrostatic engine would be equal to about 25¼ horses power, or to more than two such wheels. These results I obtain in this manner:—

Suppose the water-wheel to be 18 feet diameter, with 20 feet fall of water from above; the velocity of fall at top of wheel = 38·86 feet per second; velocity of such wheel = 11·95 feet per second; number of revolutions per minute = 12·68. Suppose the wheel has 50 buckets, and that each bucket contains 6 cubic feet of water; quantity of water expended in one revolution = 300 cubic feet; 300 cubic feet = 18,750 lbs., or 8 tons, 7 cwt., 1 qr., 18 lbs.; quantity of water expended in a minute = 104 tons, 12 cwt., 2 qrs, 15 lbs.; only about one-fourth the quantity of water expended in one revolution is really effective = 74 cubic feet, or 4,625 lbs.; circumference of wheel = about 57 feet; 57 feet × number of revolutions per minute = 726 feet space passed through per minute; 4,625 lbs. × 726 = 3,351,750 lbs. raised one foot high per minute, or about 11⅝ horses power.

Suppose the engine to expend the *same* quantity of water in the *same* time as the water wheel. Then a cylinder to contain 300 cubic feet of water at two strokes, of 5 feet each stroke = 30 feet superficial at base; diameter of water-wheel, 18 + 20; height of fall = 38 feet, 38 × 30; base of cylinder = 1,140 cubic feet, or 71,625 lbs. pressure on piston. But the average pressure = 66,562 lbs., or 29 tons, 14 cwt., 1 qr., 6 lbs. As length of stroke is to circumference 10 : 16, so will be the real effective power to 66,562. Real effective power = 41,600 lbs., or 18 tons, 11 cwt., 2 qrs., 2 lbs. Reducing the above to horses power = 8,320,000 lbs. 1 foot high per minute, or 25¼ horses power. I am, Sir, &c.,

GEO. C. WARREN.

Jan. 15, 1849.

LEADEN SHOT AND FOWLING-PIECES.

Of the origin of small leaden, or dropped shot—perhaps the simplest, and certainly the most purely philosophical, of manufactures—little or nothing is known. This is to be regretted, for a knowledge of the thoughts and circumstances that led to and attended its development, would have been exceedingly interesting.

In other departments of metallurgy, workmen toil with many tools, to mould, cast, turn, hammer, and file substances into desired forms; but the modern shot maker, as if soaring in science above his neighbours, as well as operating over their heads, mounts a tower, and listlessly pours his metal into free space, confident that, as it falls, Nature will break and mould it into the form he wants, while he stands looking on. Nor is he disappointed. By the same law that spherules of dew, of hail, and rain are shaped, shot is made—the law by which the materials of the sun and moon, the globe we inhabit, and all the mightiest and minutest orbs whirling through the heavens, were gathered round their common centres. Of creation's paramount influence, and its operations in space, what more beautiful illustration! The artist imitates his Maker; for of what is the universe composed, but of various sized shot, dropped from the hands of the Deity?

The facility with which streams of metal are changed in this way into spheres, the accuracy of outline, and beauty of finish attainable, are remarkable. But for immediate oxidation, the surface of the globules would be smooth and bright, as those of water or quicksilver. Whether the invention came in with the match-lock from the East, or is a European one, has not, that I am aware of, been ascertained. Some persons have supposed that Watts, of Bristol, who patented a process for making it in 1782, was the first maker;—a great mistake. His mode differed in nothing from the ancient one, except in dropping the fused metal from greater elevations than had been the previous practice. "For small shot," he says, "*ten* feet, and for the largest, 150 feet, or more." See *Rep. Arts*, III., 1795.

That this missile was an early accompaniment of portable fire-arms is pretty evident; but the date of its appearance, and the name of its author, are under a cloud.

That primitive muskets were devised to kill men, and, for a while, confined to that purpose, is probable; but their application for destroying smaller game was too obvious to be overlooked. Beckman says they were too long and heavy to be fired without a prop, and were *first* used in war at the siege of Parma, in 1521. Not so. Edward IV. had 300 Flemings in his service, armed with them, in 1471. They formed part of the armament of Columbus; and further, soldiers are repeatedly figured in the act of firing hand-guns, without rests, and with trigger-locks, taking sight, and handling them like modern troops, in the German translation of Vegetius. (*Enffurt*, 1511.) They appear there as common as artillery, of which greater varieties are pourtrayed than are now in use.

There is a passage in Petrarch's "*Phisicke against Fortune*,"—("Englyshed by Thomas Twynne," Lond., 1579), which implies that, in his day, they were common. He died in 1374. It occurs in the 48th dialogue, when "Reason," remarking on personal arms, says:—

"A father can leave none other inheritance to his sonne than he hath, to wyt: his bowe and arrowes, his *piece*, his shielde, his swoorde and wane, and that also which maketh up the game, his golden spurres."

Now *piece* was the old technical name for portable guns; hence, as their varieties increased, arose "Wall Pieces," "Birding Pieces," "Fowling Pieces."

The 99th Dialogue is "On Engines and Artillerie." One passage, though not relating to the special object of this paper, is worth extracting.

"*Joy.*—I have innumerable engines and artillerie.

"*Reason.*—It is marueyle, but thou hast also pellets of brasse, which are throwne foorth with terrible noyse of fire. Thou miserable man, was it not yenough to heare the thunder of the Immortal God from heaven? O, crueltie joyned with pryde! From the earth, also, was sent forth unimitable lightning, with thunder, as Virgil sayth, which the madness of men hath counterfeited to do the like: and that which was woont to be throwne out of the cloudes, is now throwne abrode with a *wooden* [?] instrument, but of a deuylish deuice, which, as some suppose, was inuented by Archimedes, at what tyme Marcellus besieged Syracuse. Howbeit, he devised it to the extent to defend the libertie of his citizens, and to auoyde or defende the destruction of his country, which you now use to the subjection or subuertion of free people. *This plague of late dayes was but rare*, insomuch as it was behelde with great woonder, but now, as your myndes are apt to learne the worst thyngs, so *it is as common as any other kind of munition*."

This extract removes all doubt respecting the "*Crakys of War*," alleged to have been employed in 1327, by Edward III., in Scotland, and subsequently at Cresci. Chaucer speaks familiarly, too, of gonnes.

Hand guns, apparently with matchlocks, were in use by English gentlemen and yeo-

man, under Henry VII., and must have been rather extensively used in fowling, and killing small animals, since a stringent Game Law, passed in the sixth year of Henry VIII., repeals former statutes touching shooting with crossbows and hand guns, and enacts that whoever keeps in his house, or shoots with a hand gun, shall forfeit it, and pay "ten pounds for every shoot," unless he have a yearly income of three hundred marks.

In the 33rd year of Henry VIII., fresh regulations were made respecting "hand guns, hagbuts, or demy-hakes." The former were to be a yard long, the latter three quarters. The preamble states that people went about with "little short guns, and little hagbuts, furnished with gunpowder, fire, and touch." All persons were prohibited to kill fowl and deer with them, except such persons as were worth, in lands, a hundred pounds yearly. One section applies to the *makers* of them. From the expression "fire and touch," it would seem that the flint lock was not then known, or but little known, to British sportsmen.—(See Keble's Statutes at Large, Lond., 1681.)

Up to this time (1542) there is no intimation of dropped shot, and we are left to conjecture what the missiles were which fowlers used. "Half shot" were in vogue, and they, I suppose, were small bullets or buck shot. It appears, however, that dropped shot was known towards the end of the reign of Henry VIII., since it is expressly mentioned, and by its old characteristic name, in a law passed in the second year of Edward VI.

"Whereas, an act was made in the 33rd year of the late King of famous memory, Henry VIII., for some liberty to shoot in hand guns, harques, and harquebuts: by which act it was provided that no person should shoot in any of the above said pieces, but at a bank of earth, and not at any deer or fowl, unless the party might dispend an hundred pound by the year. Forasmuch as the said act having been devised, as it was then thought, for necessary exercise, tending to the defence of the realm, is grown sithen to the maintenace of much idleness, and to such a liberty, as not only dwelling houses, dove-cotes, and churches, are daily damaged by the abuse thereof, by men of light conversation, *but that also there is grown a customable manner of shooting of* HAIL-SHOT, whereby an infinite sort of fowl is killed, and much game thereby destroyed, to the benefit of no man; whereby, also, the meaning of the said statute is defrauded, for that the said use of *hail shot* utterly destroyeth the certainty of shooting, which, in wars, is much requisite. Be it therefore enacted, that no person, under the degree of a Lord in Parliament, shall, from henceforth, shoot in any hand gun, within any city or town, at any fowl, or other mark, upon any church, house, or dove-cote. Neither shall any person shoot in any place *any hail shot*, or any more pellots than one at one time, upon pain," &c.—that is, a fine of ten pounds for every shot, and three months' imprisonment.

A second section declares the above is not to prejudice the rights of those allowed to shoot by the 33rd of Henry VIII. — the use of "*hail shot* excepted, as, indeed, *that kind of shot* in the said act was not meant." —(*Statutes at Large.*)

From the last remark, the inference is that this shot was introduced into England —if not invented there—between 1542 and 1548.

The objection, that the substitution of a number of shot for a single one, would diminish the previous accuracy of aim, was well taken. It is doubtful whether modern sportsmen equal—they certainly do not surpass—their predecessors in this respect. Shooting game flying, with the bow, was quite common; but the perfection of fowling was to hit a bird on the *bill* so as not to lacerate the body. This was beating the old marksman, who addressed an arrow to Philip's right eye.

In the first of James I., cap. 27—another severe game law—hail shot is forbidden to be fired from "hand guns or birding pieces," except by persons duly licensed, and then only to kill "crows, pyes, rooks, ring-doves, jays," &c., "for hawk's meat only." Here, again, the old hand gun is a regular fowling piece. When Falstaff proposed to hide himself in the chimney, Mrs. Ford told him that would not do, as "There they always use to discharge their birding pieces." The same hero describes his recruits as starting at the report of a caliver—a sportsman's gun— "Worse than a struck fowl, or a hurt wild duck."

The oldest direction for making hail shot that has fallen in my way, dates no further back than the middle of the 17th century. It is professedly copied from previous writings. The essential parts run thus:

"Melt lead down in an iron kettle, skim it, and when 'tis so hot that it begins to turn greenish, strew as much fine powdered auripigmentum (arsenic) upon it as will lie upon a shilling, to every twelve or fifteen pound of lead, which then must be stirred well, and the auripigmentum will flame. A little may be taken out in a ladle for an essay, and which, when reduced to a proper heat, may be dropped into a glass of water. If the drops prove round, and without tails, there is auripigmentum enough therein, and the temper of the heat is as it should be;

but if otherwise, more auripigmentum must be added, and the heat augmented till it be found right."

Directions then follow, to pour the metal through a perforated dish in the usual way, and to sort the shot by means of sieves.

The most remarkable part of the direction is the short space the metal fell through. The perforated dish was "placed on two bars, or other iron frame, over a tub of water, about *four inches* from the water." No wonder "the greatest care was to keep the lead at so moderate a heat, that it be not too cool to stop the holes, nor too hot, which will make the drops crack and fly;—for the cooler it is, the larger the shot will be. Such as will have very large shot, make the lead tricle with a stick out of the ladle into the water without a [perforated] plate."

It would be difficult to point out in the records of the arts an example of dulness in old workmen, so gross as the history of hail shot exposes. For about 240 years previous to Watts' improvement, its fabricators dropped it close to the vessel of water prepared to receive it, while every ounce they made, was attended with embarrassments that loudly suggested a greater fall. Had they melted the metal on a second floor, and poured it from the window, an amount of trouble and mortification would have been avoided, which no one, not practically acquainted with its manufacture, can appreciate. I know not how to account for the fact, unless by supposing no manufactory of any consequence was established, to supply the public, and that sportsmen were in the habit of making it for themselves.

That buck, or cast shot, sometimes went by the name of hail shot appears evident. In 1594, some English sea rovers, under James Lancaster, took Pernambuco. The writer of the expedition, in Hakluyt, says their muskets were provided with "haile shot, which severely gauled the Indians and Portuguese." That this was not dropped shot, appears from his next sentence. "And this is to be noted, that there was both the horse and his rider slaine with one of these shot."—*From the Franklin Journal.*

ON THE ELASTICITY AND STRENGTH OF SPIRAL SPRINGS, AND OF BARS SUBJECTED TO TORSION. BY JAMES THOMSON, JUN., M.A., COLLEGE, GLASGOW.

[From the *Cambridge and Dublin Mathematical Journal*, Nov., 1848.]

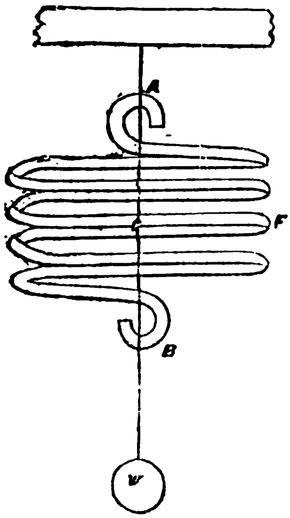
A spiral spring of the most usual kind consists of a long bar or wire, generally of a circular section, coiled up into the form of the thread of a screw.

For the purpose of attaining precision in peaking of such springs, the following definitions and preliminary explanations will be useful. The curve in which the centres of all the sections of the bar are situated, may be called the *spiral axis* of the spring. This lies in the surface of a cylinder, the axis of which may be called the *longitudinal axis* of the spring. The angle which the spiral axis makes with a plane perpendicular to the longitudinal axis, may be called the *inclination of the coil* or *of the spiral.* Each end of the bar is bent in such a way that the force applied to elongate or compress the spring may act in the longitudinal axis.* In what follows, unless the contrary be specified, the spring may be supposed to be suspended by one end, the force applied being one of tension, produced by a weight hung at the lower end.

The elasticity and strength of spiral springs have not, so far as I am aware, been hitherto subjected to scientific investigation; and erroneous ideas are very prevalent on the subject, which are not unfrequently manifested in practice by the adoption of forms very different from those which would afford the greatest advantages. Having had occasion to construct some spiral springs which, in their elasticity, strength, and dimensions, should fulfil certain definite conditions, I was led to seek for principles to guide me in determining the forms and dimensions best adapted to accomplish the ends desired.

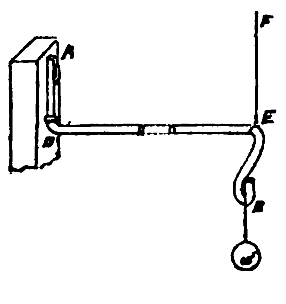
With this view, the first matter to be considered was the exact nature of the strains which act on the various parts of a spiral spring; and the whole subject became at once simple, as soon as I perceived that the only strain which produces a sensible effect is one of torsion, acting alike on every part of the coil. To render this clear, let us consider any section, P, of the bar, made by a plane passing through the longitudinal axis, AB. Now, when a weight, w, is suspended at B, the forces transferred from one side to the other of this section consist of a couple whose force is w, and whose arm is the distance, PC, from the centre of the section at P to the line, AB, together with a force, w, parallel to AB, tending to make the one side of the section slide upon the other in the direction of the longitudinal

* In fact, even if, in the construction of the spring, this matter has not been attended to, and the ends of the bar forming the points of application of the opposite forces have not been placed in the longitudinal axis; immediately on a tensile force being applied, the spring will, if it be of considerable length, adjust itself so that the force will act in that axis, except in the neighbourhood of the two ends. At those parts the spring will be weaker than towards the middle: and, if the force be sufficient to induce a permanent alteration on its form, this change will commence by the ends assuming forms of greater resistance, the longitudinal axis approaching more nearly to the line of action of the forces.



axis. The effect of this force must be extremely small, in fact, evanescent, compared to that of the couple; and the force may, therefore, be neglected, especially when the coefficients for the elasticity and strength of the material are determined in the way which will be hereafter pointed out. The slight deviation of the above-mentioned section of the bar from a circle due to the inclination of the spiral, may also be neglected in the theory, as the minute influence which it may have will also be, in a great degree, corrected by the mode of determining the coefficients.

Let now r be the radius of the bar; l, the total length coiled up; a, the radius of the coil, or the distance from the longitudinal to the spiral axis; w, any weight which may be hung on the spring; e, the elongation corresponding to that weight; and θ the angle through which a bar composed of the same substance as the spring, having its length and radius each unity, is twisted when subjected to a unit couple. This quantity, θ, may be called the coefficient of deflexion



by torsion for the substance of which the bar is composed.

Let the spiral part of the bar be supposed to be straightened out, and let the bar be supposed to be placed with one end fixed at A D; and with a couple applied at the other extremity by means of a weight, equal to w, suspended at B, and a force in the line E F equal, parallel, and opposite to that of w; the arm of this couple being equal to a, the radius of the coil.

Now it can be shown that, in bars subject to torsion, the angle of torsion is proportional to the length of the bar, to the couple applied, and inversely to the fourth power of the radius of the bar. Hence the angle of torsion in the present case, or the angle described by E B, in passing from its natural position to one of equilibrium with the couple wa is

$$=\theta\frac{lwa}{r^4}.*$$

Hence, the space moved over by a point at a distance a from the centre is

$$=\theta\frac{lwa^2}{r^4}.$$

Now a little consideration will show that this space must be equal to e, the elongation of the spiral spring due to the application of the weight w. Hence we have

$$e=\theta\frac{lwa^2}{r^4}\ldots\ldots\ldots(1).$$

This equation involves the conditions of the *elasticity*, or the *stiffness* of a spring as compared with its dimensions, and the substance of which it is composed. We will

* As these principles regarding torsion have been laid down in various works on Mechanics and Engineering, I here take them for granted. The methods of deducing them have, however, been insufficient, as it has been, tacitly at least, assumed that all the elements in the section of a bar are free from strain when the bar as a whole is free from external strain; since it is assumed that when the bar is twisted to any extent less than that which would strain its circumference to the utmost, any equal elements of its section undergo strains proportional to the distances of the elements from the centre. It seldom occurs, however, that the real condition of a bar is in accordance with this assumption; for I have shown in the preceding paper that the various particles of materials usually exist under great strains in opposite directions, which are in equilibrium with one another. The conclusions which had previously been derived are, however, in themselves correct; and in a note to the paper just referred to, I have supplied the step which was wanting in the proof by showing that the angle of torsion of a bar, or in other words, its stiffness, is not influenced by the presence or absence of internal opposing strains among its particles; although the case is very different with regard to the ultimate strength of the bar, which is materially altered by changes in those strains. From this it follows that the coefficient for the stiffness or deflexion of a bar composed of a given substance has but one value, while that for its ultimate strength may have various values. Of this more will be said in what follows.

next proceed to those of its strength and its power; or, in other words, we will enter on considerations connected with the greatest weight which it can support, and the space through which it can be elongated without rupture or permanent alteration.

In addition to the notation given above:—Let W be the greatest weight which the spring, if its particles are all relaxed when it is not loaded, can bear without taking a set; E the greatest elongation, that namely which corresponds to W; μ the utmost couple producing torsion which can be resisted by a bar whose radius is unity, composed of the same substance as the spring, and having its particles at various distances from its centre free from mutual opposing strains when it, as a whole, is subject to no strain. In the preceding paper, "On the Strength of Materials," I showed that the utmost couple which can be resisted by the bar will vary with the internal arrangement of the particles, its greatest value being $\frac{4}{3}$ and its least $\frac{2}{3}$ of its mean value, which, in the bar whose radius is unity, has just been denoted by μ. Any value of this couple, different from the mean one, adapted to a particular arrangement of the particles, may be denoted by μ', and the utmost weight and elongation in a spring having a similar arrangement may likewise be denoted by W′ and E′. It will readily be seen that μ is to be regarded as the coefficient for any given substance, of the utmost strength of a cylindrical bar composed of it to resist torsion, when the particles of the bar have been so arranged that they may be all relaxed when the bar is free from external strain. It must, however, be remarked that μ would still represent the strength of the bar, even though there were *some* mutual opposing strains among the particles, provided that the particles at the circumference be relaxed when the bar is free from external strain; and that none of the internal particles exist under so great displacements from their positions of relaxation, as to occasion their being strained to the utmost sooner than the particles at the circumference, during the twisting of the bar.

If now, in the formula $L = \frac{1}{2}\pi\eta r^3$, for the strength of a bar when it is of its mean amount, which was proved in the paper before referred to, we take $r = 1$, L will become what we have denoted by μ. Hence $\mu = \frac{1}{2}\pi\eta$, and the formula becomes L, or the utmost couple, $= \mu r^3$.

Again; since W is the utmost weight, and a the arm at which this acts, the utmost couple may also be expressed by Wa. Hence $Wa = \mu r^3$, and

$$W = \frac{\mu r^3}{a} \ldots\ldots\ldots\ldots (2).$$

The greatest elongation of which the spring can admit will be found by substituting in (1), W for w and E for e.

To justify us in making this substitution, it must, however, be here remarked that, in ordinarily formed spiral springs, the elongations continue proportional to the weights added, even up to the very greatest that can be resisted. This fact I have myself observed by an experiment conducted with considerable care, and in which any deviation from the foregoing relation which may have existed, was less than the inaccuracies of observation.*

Now, by making the substitution above indicated, of W for w, and E for e, in (1) we obtain

$$E = \theta \frac{lWa^2}{r^4} \ldots\ldots\ldots (3),$$

which, by (2), may be put in the following form,

$$E = \theta\mu \frac{la}{r} \ldots\ldots\ldots\ldots (4).$$

(*To be concluded in our next.*)

EFFLUVIA TRAPS.

Sir,—The effluvia trap represented in your Journal of last week, was invented by me, and registered (No. 1519), I think, in August last.

I am, Sir, yours, &c.,

JOHN PHILIPS.

1, Greek-street, February 14, 1849.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING FRIDAY, FEBRUARY 16.

SAMUEL LEES, Park Bridge, Lancaster, iron merchant. *For certain improvements in the manufacture of malleable iron.* Patent dated August 8, 1848.

These improvements refer, 1st, to the piling, and 2nd, to the rolling of malleable iron.

1. Instead of piling the flat bars horizontally, as has hitherto been customary, the outside of the fagot is composed of flat bars dovetailed or overlapped, and placed at right angles to each other. The inside of the

* From this two distinct conclusions may be inferred: 1st. That the angle of torsion of a bar continues proportional to the applied couple as long as the arrangement of the particles remains unaltered; and, 2nd. That the alteration in the form of the spring by the increase of its angle of inclination, and the consequent diminution of the radius of the coil, does not produce a sensible effect. For, were there any deviation from the relation stated in the former proposition, this must in the experiment have been exactly counteracted by an effect of the change of form of the spring, which, it is clear, would have been a coincidence very unlikely to occur.

fagot is made out of pieces of scrap or other iron, which are arranged vertically, or vertically and horizontally, whereby the bar, when rolled out into shape, will be of greater strength and less liable to laminate than those made after the old method.

2. The improved rolling mill consists of a main shaft, driven from any prime mover, on which is geared a spur wheel, whereby the grooved rollers are driven. The first of the series of grooves in the rollers is open at the side, so as to admit of a projection from the frame entering partially into this groove. The bar is first passed through the second groove, and the indentation formed in the side; it is then caused to pass edgeways through the first groove, whereby the bar is reduced to the proper size, while the projection, taking into the indentation, prevents it being compressed out of shape. The bar is then passed through the rest of the grooves, and finished.

The form of the grooves may be varied so as to give any desired form to the iron, and the bottom roller made to revolve in an opposite direction to the top one.

Above the rollers is a frame, which is made to travel backwards and forwards by means of suitable gearing driven from a pulley on the main shaft, and which carries a rod, to which is suspended the bar to be rolled.

Claims—1. The mode of piling or fagoting the flat bars.

2. The rolling mill in which the indentation is maintained by means of the lateral projection.

3. The mode of causing the rollers to revolve in opposite directions.

4. The arrangement of gearing for driving and reversing the frame from which the bar to be rolled is suspended.

Moses Poole, London, gentleman. *For improvements in the manufacture of casks and other similar vessels of wood.*—(A communication.) Patent dated August 8, 1848.

The improvements which form the subject of this patent embrace all the operations usually gone through in forming wood into staves and heads, and ultimately into casks, tubs, &c.

First, we have an apparatus for hollowing out the stave, which consists of a curved bed-plate, over which the stave is drawn, by means of a fluted roller, under curved blades fixed on a shaft. The stave is prevented from jumping up by a plain roller, which holds it down.

2. The stave is cut to the required length by two circular saws, one of which is moveable upon the common shaft, so that the distance between the two may be regulated to suit the length of the stave or height of the cask.

3. The stave is placed in a frame and sprung to the required bend by means of a lever, which acts upon its centre. The frame is then swung to a saw, which cuts the sides of the staves to the required taper.

4. The frame is swung to a jointer, which travels from the centre of the stave to each end alternately.

5. The staves are built in a circular frame, and held by a head-plate, which grips them, and holds the cask thus formed in a horizontal position, when it is submitted to the action of a turning tool, which is supported in a frame made to travel upon two ways by means of suitable gearing and weights.

6. A hoop, of a larger size than those which are intended to remain permanently on, is driven from the end towards the centre, to compress the staves together by means of a rack connected to the hoop, which is made to travel in that direction by means of suitable gearing. And the cask is then submitted to several other operations to be finished.

[Of the remaining parts of the machinery we can give no description, for this simple reason, that there is no description of them given in the specification. They are merely referred to thus:—"Fig. 8 is the dowelling machine." "Fig. 9 is the crossing machine," &c., and the reader is left to find out from the accompanying lithograph (the off leaf, apparently, of some trade circular) how those other machines act, and in what their peculiarities consist. But indifferent specifying this; not, certainly, such "a full and particular description" as the law requires.]

Claim.—The arrangement and combination of apparatuses for effecting the different operations in the manufacture of casks.

William Thomas Henley and David George Foster, *for certain improvements in telegraphic communication and apparatus connected therewith, parts of which improvements may be also applied to the moving of other machines and machinery.* Patent dated August 10, 1848. For specification, see *ante*, p. 145.

Samuel George Hewitt, Buchanan-street, Glasgow, engineer. *For improvements in the construction of certain parts of railways.* Patent dated August 11, 1848.

[In consequence of Sunday last, the 11th instant, being a *dies non*, the specification of this patent became due on the 10th instant (Saturday last), but was not enrolled until Monday, the 12th (the date of the stamps), which renders it null and void. The specification is written—and in some parts very ill written—on sheets of common paper, and has altogether a most slovenly and unbusiness-like appear-

ance. This is the more to be regretted, since the invention appears to be of more than average merit. As it is well the public should know the value of the involuntary present which Mr. Hewitt has made to them, we subjoin an analysis of it.]

The patentee describes, 1st. A new construction of turn-table, whereby the foundation is rendered less expensive than usual, access to the parts is facilitated, and the injurious effects of the shocks from heavy bodies passing over it are considerably reduced. 2nd. To a peculiar arrangement of switches; and, 3rd. A peculiar arrangement and combination of the switch-rails with other mechanism, whereby the services of an attendant are dispensed with.

1. The turn-table consists of an arched circular frame, fitted with a step in the centre, in which rests the vertical central pillar. The frame is supported by arms or stays, which project from it and bear upon a sole-plate, wherein they are held by wedges. The sole-plate is larger than the arms or stays, to allow of the frame being moved in any horizontal direction.

In the under surface of the frame, and exactly opposite to the bearing of the pillar, is a cup to receive the head of the screw of the hydraulic ram or other apparatus employed to raise the table. The pillar is maintained in a vertical position by a collar, which encircles it at top, and is fitted with friction rollers on the inside periphery, or bored accurately to fit. This collar is supported in a triangular support, which consists of bars riveted at bottom to the arms or stays of the frame, and inclined inwards towards the collar at top, to which they are also riveted. The platform, which is constructed partly of wood, rests upon the pillar, and is attached by means of vertical and angular trusses to the roller-frame, which is concentric with the central frame, and fitted with rollers that bear against the circumference of the latter. A small portion of the platform, which carries the end of the rails, is kneed, and rests (when it is in the position to allow of the passage of a carriage) upon a roller placed in a corresponding position in the outside ledge.

2. [The peculiar arrangement of switches would scarcely be intelligible without diagrams.]

3. The improvement in switch rails consists in riveting loosely to the inside of the rail a bar of iron, which is attached at the other end to a cross lever keyed on a longitudinal shaft, which is supported in bearings made fast to the sleepers. The other end of the lever carries a counterbalance weight. The bar is at an angle to the horizontal plane of the rails, and the shaft is so connected to the switch-rail, that when the wheel runs on and presses down the bar, the shaft, which is thereby made to revolve partially, shall bring the switch-rail into the proper position for receiving the wheel.

We add the "claims," though, of course, now legally good for nothing.

1. The method of constructing turn-tables which allows of employing a less expensive foundation, admits of an easier application of power, and of the employment of wood; also the mode of diminishing the injurious effects of shocks arising from the passage of heavy bodies over turn-tables.

2. The arrangement and combination of switches.

3. The arrangement and combination of mechanism with switch-rails, whereby they are brought into the required position prior to the passage of the carriage thereon, without the assistance of a workman, or the direct action of the wheels of the carriage thereon.

[We give the Editor of the *Glasgow Mechanics' Magazine* our free leave to add the preceding abstract and comments to his many unacknowledged appropriations from our pages. He gave lately—as if from himself—some sharp remarks which we made on the loss of the patent of another party from the same cause, and is, of course, too just a man to suppress this additional instance, simply because he is himself the hero of the blunder. Ed. M. M.]

John Metcalf, of Little Bolton, Lancaster, machine maker, and Robert Halliwell, of the same place, mechanic. *For certain machinery or apparatus for preparing and spinning cotton and other fibrous substances.* Patent dated August 8, 1848.

The patentees' first improvement in machines for spinning consists in the addition of certain parts whereby the stopping of the machine is effected when any one of the rovings either breaks or ceases to flow into the feed rollers. The way in which this is effected is by passing the rovings underneath the end of a balanced lever against which they rub as they enter between the feed rollers. The moment that any of the rovings cease to flow, or get broken, then the balance lever no longer maintains its level position, and in falling down detaches a catch, which allows a weight to act upon the band which drives the machine, and throws it from off a fixed on to a loose pulley, which causes the machine to stand until the attendant has repaired the default in the roving.

The second improvement consists in an addition to the presser of a curved steel spring, the curvature of which is so proportioned that it presents a uniform pressure upon the "presser," and upon the bobbin throughout the whole course of its being wound upon the spoul.

A third improvement consists in the

application of an excentric mangle wheel and pinion for the purpose of raising the coping rail (instead of the heart wheels generally used for that purpose) so that the bobbins may be built upon the spouls of one uniform diameter.

A fourth improvement consists in an arrangement of wheel gearing, racks, &c., for building the bobbins upon the spouls in such a manner that the bobbins may be taken from off the spouls without reversing the motion for that purpose.

A fifth improvement has relation to the construction of certain parts of a self-acting mill; they are of a very complicated nature (although simple enough for effecting the purposes intended) and defy mere verbal description. The principal objects sought to be obtained thereby are: "the winding-on motion by the varying position of the counterfaller" — the "breaking off" and putting down the faller previous to the running in of the carriage—and the moving the carriage parallel to the drawing rollers.

The claims of this specification, eleven in number, bear each reference to different figures in the drawings, and therefore could not be understood without the drawings themselves. The substance of them may be gathered from the preceding abstracts.

Joseph Simpson, Manchester, civil engineer, and James Alfred Shipton, Manchester, engineer. *For certain improvements in steam engines.* Patent dated Aug. 14, 1848.

These improvements refer to a new construction of steam-engine, governor, and throttle-valves.

1. The steam engine consists of an oblong steam chamber, in which works a drum or piston keyed eccentrically upon an axis which is supported in moveable bearings in side rods, and furnished at the ends with cranks, whereby rotary motion is imparted by means of connecting rods to the main shaft. To keep the ends of the drum steam-tight, they are cut down, and bevelled rings put on, which are kept tight, by means of wedges and springs placed between them and the shoulders of the piston, against the surfaces of the ends of the cylinder. The steam, which is admitted through an opening in the side of the cylinder, is conducted by passages therein- above and below the piston. The valves are kept steam-tight by rings and springs, similar to those before described. In the side of the cylinder, opposite to the steam ports, is a recess fitted with a plate having springs behind it, whereby it is kept in constant contact with the piston, and, consequently, steam-tight. The recess and steam ports are placed in the two sides of the chamber which are not curved. The rest of the arrangements for working the valves, pumps, &c., are mere modifications of well known arrangements, such as would suggest themselves to any one, and therefore are unnecessary to be described.

2. The governor consists of a vase containing a cylinder partially filled with water, in which is a screw. In the centre of the screw is a tube, which passes through a water-tight aperture in the bottom of the vase and above the level of the water. A rod is placed in the tube, which rests upon a step underneath the vase, and is fitted with a bevel wheel, driven by another bevel wheel which receives motion from the main shaft. The rod is furnished with a fixed feather, on which rests the screw, and at top with a fixed collar, between which and the collar at the top of the screw, is a spiral spring coiled round the rod. The collar on the top of the screw contains a groove, in which is a loose collar having projecting studs, which take into links attached to one end of a lever. According to the velocity of the screw it will ascend and compress the spring until it finds a neutral point, and will, consequently, depress or elevate the free end of the lever.

The arrangement of valves would require diagrams to be intelligible to the general reader, while our engineering friends will, perhaps, be able to gather sufficient from the claims, which are as follows:—

Claims.—1. The mode of constructing a steam engine, working with an eccentric piston, which is caused to reciprocate in a steam chamber, the width of which is equal to the diameter of the piston; the axes of the eccentric piston being caused to move a distance equal to the eccentricity of the piston. Also the mode of packing the slide valves by bevelled rings.

2. The constructing and using of a revolving spiral screw inclosed in a chamber containing water or other fluid, and applied to the purpose of a governor of a steam engine.

4. The mode of constructing "sliding cut-off valves" containing a butterfly throttle-valve in the side or back of the said valve, which is worked by a second spindle passing through the main spindle, having a stuffing-box in the top, or through any other part of the steam chest, to the outer surface; and the mode of protecting the seating or jointing faces of the stop valves from the ravages of a volume of steam or other fluid which passes through, by having a first part to cut off or regulate the passage of the steam, and a second part to finally cut it off. Also the arrangement in any kind of valve for effecting the same purpose.

James Henderson, Surrey Canal Dock, millwright. *For improvements in machinery for cleansing and polishing rice, pearl barley, and other grain and seed.* Patent dated August 14, 1848.

The patentee employs an iron cylinder, 2 feet 6 inches diameter, and 2 feet 8 inches long, which is inclosed in wood. Over the wood, canvass is strained, to which emery, of the quality No. 1, is applied, and caused to adhere by means of glue. This cylinder is inclosed in another, composed of wire gauze, containing fourteen holes to the inch, which is closed at both ends, with the exception of openings for the admission or outflow of the grain, which are regulated by slides. The distance between the circumference of the two cylinders is about one inch and a half, and they are both placed in an inclosed position. The axis of the iron cylinder is passed through the sides of the wire gauze one, whereby it is made to revolve (by connection with any prime mover) at a speed of about 200 revolutions a minute.

Claim.—The application of emery to the rubbing surfaces employed in cleansing and polishing rice, pearl barley, grain, and other seed.

Thomas Varley, Bury, Lancashire, engineer. *For certain improvements in steam-engines.* Patent dated August 14, 1848.

These improvements are stated to be only applicable to such stationary and marine engines as are not oscillating, and consist in placing the steam and exhaust valves (whether equilibrium or stalk valves) in the cover and bottom of the cylinder, one on each side of the vertical line of the piston-rod. On one side of the cylinder there is a passage into which the steam-pipe opens, which conducts the steam to the valves, while on the opposite side of the cylinder, there is a second passage into which the passages from the top and bottom exhaust pipes open, and which conducts the used steam to the condenser. The top steam valve is attached to a vertical rod, fitted with a roller at bottom, which travels over a horizontal cam wheel, and the bottom steam valve is keyed upon a lever which is also worked by the same cam. The top and bottom exhaust valves are fastened to a vertical rod, which is worked by a vertical cam wheel. Motion is communicated to these cams by ordinary gearing, and by this arrangement two rods are used for working the valves instead of four, as hitherto.

Claim.—The novel and peculiar modification of the steam and exhaust valves (whether equilibrium or stalk valves) of stationary or marine engines, not oscillating, in the cover and bottom of the cylinder, and the mode of connecting and working them.

Joshua Cooch, Harleston, Northampton, agricultural implement maker. *For certain improvements in sack-holders.* Patent dated August 10, 1848.

For specification and claims see vol. xlix., p. 524.

WEEKLY LIST OF NEW ENGLISH PATENTS.

John Giblett, of Trowbridge, Wilts, gentleman, for the improvements in the manufacture of woolen cloth. February 10; six months.

George Edmond Donisthorpe, of Leeds, manufacturer, and James Milnes, of Bradford, York, for improvements in apparatus used for stopping steam engines and other first movers. February 12; six months.

Jarvis Palmer, of Camberwell, Surrey, merchant, for improvements in matches, lighters, or similar articles, for igniting combustible bodies, in the mode or modes of manufacturing the same, and in machinery applicable therein; also in match and other boxes, and in machinery for manufacturing the same. February 12; six months.

William Harris, of Battersea, Surrey, shoemaker, for a new or improved mode of preparing leather. February 12; six months.

William Brewer, of Malcolm-place, Clapham, Surrey, and John Smith, of Southville, South Lambeth, Surrey, manufacturers, for certain improvements in the manufacture of paper and card-board, and in producing watermarks thereon, and also in apparatus and machinery to be used for such purposes. February 12; six months.

Christopher Nickells, of York-road, Lambeth, for improvements in the manufacture of woollen and other fabrics. February 12; six months.

Edward Newton, of Chancery-lane, civil engineer, for improvements in engines, or apparatus principally designed for pumping water. February 12; six months.

Matthew Townsend, of Leicester, framework-knitter, and David Moulden, of the same place, framework-knitter, for improvements in machinery for the manufacture of looped fabrics. February 13; six months.

Edward Newton, of Chancery-lane, civil engineer, for improvements in machinery for hulling and polishing rice and other grain, or seeds. Being a communication. February 13; six months.

Edward Lord, of Todmorden, Lancaster, machinist, for certain improvements in machinery, or apparatus applicable to the preparation of cotton and other fibrous substances. February 13; six months.

Achille Chandois, of Faubourg du Temple, Paris, manufacturing chemist, for improvements in extracting and preparing the colouring matter from orchil. February 14; six months.

William Chambers Day, of Birmingham, Warwick, iron founder and weighing machine manufacturer, for improvements in machinery for weighing. February 14; six months.

Hugh Lee Pattinson, of Washington House, Gateshead, Durham, chemical manufacturer, for improvements in manufacturing a certain compound or certain compounds of lead, and the application of a certain compound or certain compounds of lead to various useful purposes. Feb. 14; 6 months.

Richard Ford Sturges, of Birmingham, Warwick, Britannia-ware manufacturer, for improvements in the manufacture of candlesticks and lamp pillars. February 14; six months.

John Erwood, of Hoxton, Middlesex, paper hanging manufacturer, for improvements in the manufacture of paper hangings. February 15; six months.

The Cigar Nuisance.—One day this week, our premises narrowly missed destruction by fire from the remains of a lighted cigar having been pitched through the front area grating, and setting fire to the adjoining window frame. The same thing occurred once before. We ascribe without hesitation the fire to the cigar nuisance, because we know of no other way in which it could have occurred—except from malice, of the existence of which towards us we have no suspicion. We make no doubt that many fires are occasioned in this way, and could almost wish to see the same rule established in this capital as in Berlin, that no one should be at liberty to smoke in the streets, except on condition of *consuming his own smoke and swallowing the ashes.*

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subject of Design.
Feb. 7	1765	Josiah Jackson	Birmingham	Pen.
"	1766	William Riddle	East Temple Chambers, Whitefriars	Self-igniting gas-burner.
"	1767	Cambell and M'Nab	Greenock	Apparatus for casting sugar moulds.
"	1768	John Key	Wemyss Colliery	Slop-cutting apparatus for tile machinery.
8	1769	S. Newington	Keale Park, Kent	Hand row hoe, and cultivator.
"	1770	T. Tillock	Bond-street	Haut-ton vesture.
"	1771	Bedington and Docker,	Birmingham and London	Double Argand lamp.
9	1772	E. Ranwell	Red Cross-square, London	Improved scale pan for weighing and discharging coal and other materials.
"	1773	W. Winsor	Rathbone-place	Harding's lesson desk.
"	1774	Elias and Reuben Levy,	Manchester	Leviathan vest.
"	1775	Joseph Lillie	Manchester	Improved boiler with internal flues.
"	1776	Samuel Clutton	Paddington	Cold draught preventer.
10	1777	J. N. Marshall	Bristol	Heated air propeller.
"	1778	H. L. Marshall and Samuel Bayless	Oxford street	Adjuster to be applied to braces and fastenings for waistcoats, trousers, drawers, belts, &c.
14	1779	Scholfield and Sons	Birmingham	A gamella or gold washer.
"	1780	Job Clark	Willen Hall, Staffordshire	Safety spring bolt.
15	1781	T. H. Busbridge and G. F. Busbridge	East Malling, Kent	Dandy roller for paper-making.

NOTICES TO CORRESPONDENTS.

"A. W.'s" *letter is written in a fair spirit, and, though it has not changed our opinion in regard to the particular invention treated of, it shall have an early place.*

"B. V. R."—*Better pay a moderate license-duty than risk a lawsuit. Beware of advisers who rejoice in wisps of straw about their ankles.*

"V. T."—*New; but not of sufficient value to be worth patenting.—See* "Mech. Mag.," *vol. xlv. and xlvi. passim.*

Stenson's specification. The continuation is unavoidably deferred till our next.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co. Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

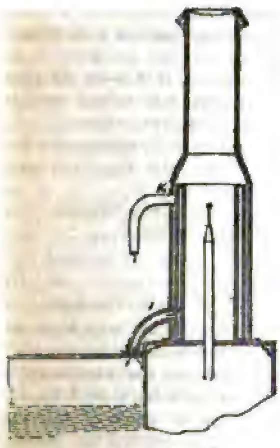
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1333.] SATURDAY, FEBRUARY 24, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

STENSON'S PATENT IMPROVEMENTS IN STEAM ENGINES AND BOILERS.

Fig. 40. Fig. 37.



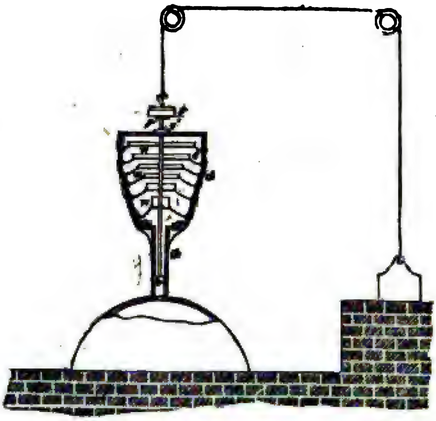


Fig. 39. Fig. 38

Fig. 40.

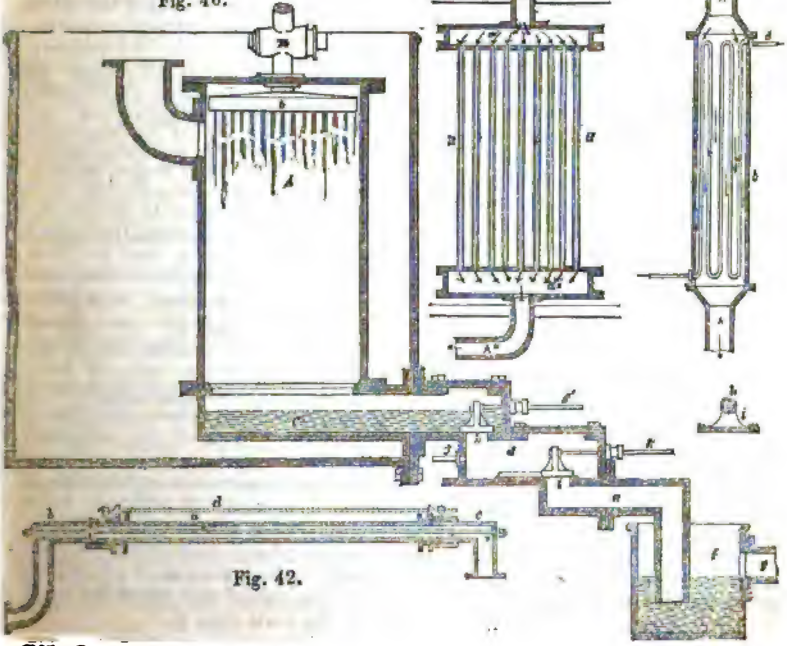


Fig. 42.

STENSON'S PATENT IMPROVEMENTS IN STEAM ENGINES AND BOILERS.
(CONCLUDED FROM P. 124.)

Self-acting Damper. (*Claim Fifth.*)

A SELF-ACTING damper for high-pressure boilers, of a new construction, is represented in fig. 37. To the top of the boiler there is jointed a vertical cylinder *a* of an area equal to one square inch, and on this cylinder is mounted a conical frame, *d*. The cylinder has a piston *b*, open to the action of the steam from the boiler, the rod of which passes up through a collar *g*, in the top bar of the frame *d*. The rod is loaded with weights *f*, which rest on a collar of the rod at *g'*, and are equal to twenty-five pounds pressure per square inch, or such pressure as may be desirable on the boiler. At the top of the weights, *f*, (which are a counter-poise to the damper) there is a ring by which the weighted piston is linked to a chain which connects it with the damper. A series of weights *w w*, are slid freely upon the piston rod, increasing progressively in size from the bottom upwards, and supported each by three curved stays, *e*, *e*, projecting from the inside of the frame *d*, by which they are kept at about 2 inches apart from one another, and prevented from pressing against the piston rod. When the pressure of the steam on the boiler exceeds twenty-five pounds per inch, the piston ascends, and raises through the medium of the collar *g'*, the first weight, more or less up towards the second weight, which is supposed to be equal to five pounds per inch pressure. On the pressure exceeding thirty-five pounds, the first and second weights are more or less raised up towards the third, and so on to the top; the damper being lowered as the weights ascend, and *vice versa*.

Feed Water and Condensation.
(*Claims Sixth and Seventh.*)

To heat the feed water in the case of condensing engines, previous to its admission into the boiler, I adopt an arrangement shown in fig. 38. A is the exhaust or eduction pipe leading from the cylinder, and *b*, an enlarged prolongation of that pipe, which is connected at its under extremity to the pipe A which leads to the condenser.

The cold water from the feed pump is forced, through a coil of pipes, C, placed inside of the enlarged portion *b*, of the exhaust pipe, and becomes considerably heated by the surrounding steam before passing out at *d*, towards the boiler.

An arrangement, the converse of the preceding, is shown in fig. 39, whereby the condensation of the waste steam is accelerated, and the quantity of injection water required for the purpose is considerably reduced. B B is an air chamber placed in any convenient position, and leading to the ash pit, through which a strong current of air is constantly flowing inwards from the external atmosphere. The exhaust-pipe, A, is conducted into this chamber, where it discharges itself into a receiver, a^1, which is connected by a series of vertical pipes, *p p*, with a second receiver, a^2, from which a pipe, A^2, leads to the condenser. The current of cold air which is constantly passing between the pipes, serves to cool and condense the steam within.

The ash-pit should be closed in front by a door with an eye piece of talc in it, and should only be opened for cleaning the fire-bars, or removing the ashes.

The air-pump ordinarily used in condensing engines may be entirely dispensed with, or at all events greatly reduced in dimensions by adopting the arrangement represented in fig. 40. A, is a condenser of the ordinary form, into which the steam is admitted after leaving the cylinder. *b*, is a close vessel of similar form, of nearly as large an area as the condenser, from the upper part of which a pipe rises, to which pipe is fitted a water injection cock, *m*. The under side of the vessel, *b*, is perforated with a number of small holes, the aggregate area of which holes, is fully equal to that of the injection cock. *c*, is a water chest or chamber, which is placed on the same level, or rather somewhat lower than the bottom of the condenser, A, and has an opening in its bottom plate, which communicates with another chamber, *d*, immediately under it, which last chamber has also an opening through its bottom-plate communicating with an exit pipe, *e*, the lower end of which dips into the hot well, *f*, and below the water line of the waste pipe, *g*.

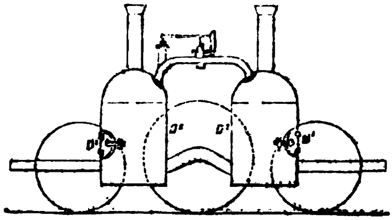
The mode in which this condenser operates is as follows; the steam is conducted into the condenser by the exhaust pipe, and the injecting water admitted to it through the vessel, *b*, in a series of small streams, whence I call that vessel the water disperser; the water of condensation rests in the chamber, *c*, upon the valve, *h*, which is made so as to slide over the opening into the chamber *d*, which opening may be closed at intervals by means of the rod, *g'*. On opening the valve, *h*, the water falls by its own gravity into the chamber, *d*, and on that valve being closed, and a small jet of steam admitted into *d*, by means of the pipe, *j*, which is connected with the boiler or steam pipe (and is furnished with a cock or valve to be opened at intervals corresponding with the openings of the valves, *h* and *i*) the vacuum in *d* is destroyed and a pressure produced in that chamber of not less than that of the atmosphere. The valve, *i*, now opened by the rod, *k*, and the water of condensation in the chamber, *d*, falls through the pipe, *c*, into the hot well, *f*, and escapes at the waste-pipe, *g*.

The valve-rods, *k* and *g'*, are worked by cams or eccentrics at such times or intervals as may be found necessary to prevent an accumulation of water or gases in the condenser, A. A small air-pump (much smaller than is ever used in condensing engines) may be attached to the chamber, *d*, for the purpose of extracting any aëriform gases that may collect in the interior of the apparatus; the rods, *k* and *g'*, are worked through the stuffing boxes, and the valves, *h* and *i*, are so fitted that no upward pressure can remove them from the faces of metal on which they are made to slide.

Application to Locomotive Boilers.
(Claims Eighth and Ninth.)

To obtain, in the case of locomotive engine boilers, as large a fire surface as may be, without any increase in the quantity of fuel consumed, and to lower at the same time the centre of gravity, I propose to have two boilers to each engine, instead of one, as usual. The necessary arrangements for this purpose are shown in fig. 41. The axles of the wheels pass between and outside of the boilers. To each boiler there is a separate chimney, and to each chimney a separate blast pipe, but the steam cham-

Fig. 41.



bers and water spaces of the two boilers, are respectively connected by junction pipes. The door to the fire-places may be placed at D^1D^1, or perhaps more conveniently at D^2.

To expand and dry the steam in the case of locomotive boilers, before its admission to the working cylinders, I propose to insert within the chimney immediately above the smoke-box (see fig. 40) a longitudinal steam case, through which the steam is passed on its way to the cylinders. I, is a pipe which conveys the steam into this case; and K, another pipe by which it is transmitted in its dried and expanded state to the working cylinders.

Gauge Cocks. (Claim Tenth.)

To compensate in some measure for the sudden fluctuations of the water level to which locomotive boilers are subject, from inequalities in the rails and rapid ebullition, and the consequent uncertainty in the indications afforded by gauge cocks, I propose to attach to the inner ends of the gauge cocks, two concentric cylinders of thin sheet copper placed about a quarter of an inch apart. The sides of both cylinders are perforated all over with small apertures (the top and bottom remaining entire); those of the inner cylinder are about one-eighth of an inch, and those of the outer about one-sixteenth of an inch in diameter, and the aggregate area of both sets of apertures is a little more than the area of any one of the gauge cocks. In consequence of the equalising effect of these apertures, th height of water exhibited by the gauge cocks will be always very nearly the mean height of the water in he boiler.

Strengthening the Steam Pipes.
(Claim Eleventh.)

In order to lessen the risk of accidents

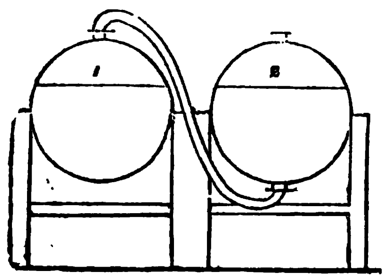
from the rupture of the steam pipes employed in steam boilers and engines, I propose to strengthen them by means of tension bolts in the manner represented in fig. 42. *a*, *b*, *c*, are three steam pipes, *a* being an intermediate one, which is fitted with its ends into two stuffing boxes in the usual manner, as a provision for the expansion of the pipes. The steam exerting a force at *x*, *x*, which has a tendency to burst the pipes *b* and *c*, I fix a tension bolt, *e*, inside these pipes, as shown, and secured at the ends by nuts. The ends pass through two packed collars, or glands, to prevent leakage. Or, I sometimes place the tension bolt outside the pipes, and secure the ends through snugs, as shown by the rod *d* and its connections with the pipes.

CASE IN EVAPORATION.

Sir,—Will you have the goodness to allow me to submit to the consideration of your scientific readers the following case?

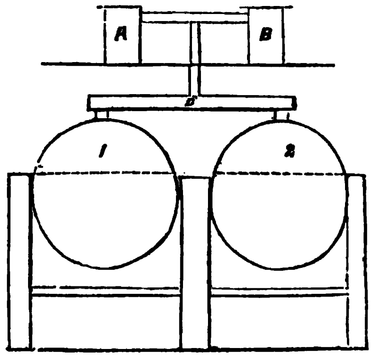
Suppose fire to be made under boiler No. 1, in fig. A, only, and that the steam from it is admitted into the bottom of No. 2, the safety-valve of which is loaded with 9 lbs. to the inch. Will not evaporation take place in No. 1 alone, until the water in No. 2 has arrived at the boiling point (under that pressure), and will not evaporation then immediately commence in No. 2—the two boilers now

Fig. A



giving out the same quantity of steam (the extra radiation not taken into account) as No. 1 would if acting alone? Suppose then the steam to be admitted into the top instead of the bottom of No. 2 (radiation being carefully guarded against), would not this steam, in contact with the surface of the water in No. 2, be constantly robbed of a portion of its sensible as well as latent heat? And would it not, in time, bring up this water to the point of ebullition, causing it to contribute more or less to the general evaporation, and in so far reducing that in No. 1?

Fig. B



Again; suppose the boilers 1 and 2 set side by side, as in fig. B, burning the same quantity of coal, evaporating a like quantity of water, and supplying the cylinders A and B with 50 measures per minute, of 6 lbs. pressure; that an improvement is made in setting No. 1, which, if worked singly, would enable it to supply the cylinder, A, with 50 measures, of 9 lbs. pressure, evaporating, of course, a proportionate increase of water (consuming no more fuel than before;) but that they are continued to be worked together, each supplying its quota, the one of 6 and the other of 9 lbs. to the inch, through the common pipe, C: what would be the pressure of this united volume of steam, and what the temperature? Would it not be 7½ lbs. and 235° (nearly), the one acquiring and the other losing about 3°·8? And in thus elevating the temperature of the steam in No. 2, would not a portion of the heat from No. 1 be transmitted to the water, thereby causing increased ebulition, and a tendency to equalize the evaporation? Or, in other words, would not the heat thus abstracted from No. 1 diminish the evaporation in that boiler in the same ratio in which it increased it in the other, and would the evaporating power of No. 1 be fairly tested by measurement of fuel and water—the steam thus commingling with that of No. 2?

F. B. O.

ON THE MOST ECONOMICAL FORM OF A BUILDING. BY MR. TATE, OF THE NATIONAL SOCIETY'S TRAINING COLLEGE, BATTERSEA.

In this calculation, we shall suppose that the area of the ground plan and the height of the walls are given; that the cost of all the internal fittings, such as doors, windows, staircases, flooring, plastering, &c., are constant quantities; and that the variation of the cost of the building depends upon the ratio of its length to its breadth. By increasing the length, we obviously increase the cost of the walling, and at the same time decrease the cost of the roofing; and, on the contrary, by decreasing the length, we decrease the cost of the walling, and at the same time increase the cost of the roofing and joisting; hence the cost of the building, admits of taking a minimum value, depending upon the relative dimensions of the base of the building.

Let a = the given area of the ground plan in square yards.
h = the height of the side walls in yards.
p = the price of the walling per square yard.
β = the given angle of the pitch of the roof, which we shall suppose to be a hipped roof.
x = the breadth of the building in yards.

Then we have

$$\text{Length of the building} = \frac{a}{x}$$

$$\therefore \text{ Area of the walls} = \left(x + \frac{a}{x}\right)h,$$

$$\therefore \text{ Cost of the walls} = \left(x + \frac{a}{x}\right)hp = hpx + \frac{ahp}{x} \dots (1).$$

Let $g = qx + r \dots (2)$, represent the relation of the cost of a square yard of roofing to the breadth of the building; where g is the cost of a square yard to the variable breadth x, and q and r are constants which must be determined from two cases ascertained from experience: thus, suppose it has been found that g equals p_1 when the breadth is b_1, and that g equals p_2 when the breadth is b_2, then

$$\begin{Bmatrix} p_1 = qb_1 + r \\ p_2 = qb_2 + r \end{Bmatrix}$$

$$\therefore q = \frac{p_1 - p_2}{b_1 - b_2} \dots\dots (3),$$

Moreover, we have,

$$b_2 p_1 = qb_1 b_2 + rb_2,$$

$$\text{and } b_1 p_2 = qb_1 b_2 + rb_1,$$

$$\therefore r(b_1 - b_2) = b_1 p_2 - b_2 p_1,$$

$$\therefore r = \frac{b_1 p_2 - b_2 p_1}{b_1 - b_2} \dots (4);$$

hence (3) and (4) give the value of the constants in (2).

Similarly let $g_1 = q_1 x + r_1$, represent the relation of the cost of a square yard of joisting to the breadth of the building.

We now proceed to determine expressions for the cost of the roof and joisting.

$$\text{Length of the rafter} = \frac{x}{2} \cdot \sec\beta.$$

$$\text{Mean length of the roof} = \tfrac{1}{2}\left\{\frac{a}{x} + \left(\frac{a}{x} - x\right)\right\}.$$

$$\text{Mean breadth of each hip} = \frac{x}{2}.$$

$$\therefore \text{ Mean girt of the roof} = \frac{a}{x} + \left(\frac{a}{x} - x\right) + x = \frac{2a}{x},$$

$$\therefore \text{ Area of the roof} = \frac{2a}{x} \times \frac{x}{2} \cdot \sec\beta = a\sec\beta,$$

which is a constant quantity; therefore the cost of the slating will also be a constant quantity.

Or we may at once obtain this result on the principle of projection; thus

Area roof : its horizontal projection : : 1 : cos β,

$$\therefore \text{ area roof} = \frac{a}{\cos\beta} = a \sec\beta.$$

$$\therefore \text{ cost of roofing} = a \sec\beta \times g = a \sec\beta\ (qx+r) \ldots (5).$$

$$\text{Cost of joisting} = a\,g_1 = a(q_1 x + r_1) \ldots (6).$$

Adding together (1), (5), and (6), we have

$$\text{Cost of the building} = hpx + \frac{ahp}{x} + a \sec\beta\,(qx+r) + a(q_1x+r_1) + a \text{ constant}$$

$$= (hp + aq\sec\beta + aq_1)x + \frac{ahp}{x} + a \text{ constant},$$

$$= kx + \frac{k_1}{x} + c,$$

where k is put for $hp + aq \sec\beta + a\,q_1$, and k_1 for ahp.

Differentiating this expression, and putting the result equal to zero, we have

$$kdx - \frac{k_1 dx}{x^2} = 0,$$

$$\therefore k - \frac{k_1}{x^2} = 0, \text{ and } x = \left(\frac{k_1}{k}\right)^{\frac{1}{2}},$$

restoring the values of k_1 and k,

$$x = \left\{ \frac{ahp}{hp + aq\sec\beta + aq_1} \right\}^{\frac{1}{2}} \ldots . (7),$$

which is an expression for the breadth of the building.

If the cost of the roof and joists be taken as constants, then we must have $q=0$, and $q_1=0$, and eq. (7) becomes

$$x = \left\{ \frac{ahp}{ph} \right\}^{\frac{1}{2}} = a^{\frac{1}{2}};$$

in this case, therefore, the plan of the building must be a square, a result which is well known.

ON IMPACT, AS EXEMPLIFIED IN PILE DRIVING.

Sir,—The following remarks on impact were written several years ago (at the time Nasmyth's steam hammer was first set to work) and were intended to be forwarded to you then, but from some cause or other were never sent. Mr. Smith, of Wexford, having in his last letter, p. 58, drawn attention to the subject of impact, I now send them to you, in the hope that the publication of them at this time may not be without its utility.

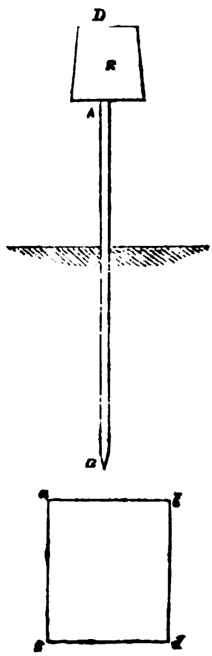


Fig. 1.

Fig. 2.

Let AB, fig. 1, be a pile, about to be driven by the ram, R, falling on it. Put R = the weight of the ram, P = the weight of the pile, H = the vertical space through which the ram falls before it reaches the pile; then RH = the work expended in raising the ram to the height D, and also the work in the ram the instant it reaches the head of the pile after falling from D; but, by the laws of falling bodies, $H = \frac{1}{2g}V^2$, where g = the depth given, and V the velocity of the ram after it has fallen through the space H. Therefore,

$$RH = \frac{R}{2g}V^2 \ldots\ldots\ldots (1).$$

Now the momentum in any system of

bodies after impact, is equivalent to the momentum before impact. Hence, if V^1 = the velocity of the ram and the pile, the instant after the blow,

$$RV = (R+P)V'$$

or $$V' = \frac{RV}{(R+P)} \dots\dots\dots\dots (2).$$

And since

$$\frac{R}{2g}V^2 \text{ (equation 1)},$$

represents the amount of work in the ram the instant before impact, so by similar reasoning

$$\frac{(R+P)V'}{2g} =$$

the work in the ram and pile, the instant after impact. Substituting for its value in equation (2),

$$\frac{R+P}{2g}V' = \frac{R^2V^2}{2g(R+P)} \dots\dots\dots (3).$$

Which is the effective work in the ram and pile, when the latter begins to move.

The main obstructions which the pile meets with when first driven are, first, the resistance at the extremity, B, and, second, the resistance along its sides. The former we will suppose constant, and represented by C. The other, F, varies as the depth to which the pile is driven; put x = any variable depth. Then on this supposition the total amount of opposition to the pile from starting until it has reached the depth, x, is

$$= Cx + \frac{Fx^2}{2}$$

Now both the ram and pile have moved together through the same space, x, and have hence acquired a proportionably additional force. Hence the full amount of work expended from the commencement of impact till the motion ceases, is

$$= \frac{R^2V^2}{2g(R+P)} + (R+P)x, \text{ or}$$

$$\frac{R^2V^2}{2g(R+P)} + (R+P)x = Mx + \frac{Fx^2}{2} \dots\dots\dots\dots\dots\dots (4),$$

is the equation to the action of the ram in driving a pile.

Mr. Smith will see from this that I do not entertain the same view of the subject that he does. I cannot bring myself to think that the WORK inherent in a moving mass can be represented by mere weight or pressure.

There are, in fact, but two primary elements in mechanics, viz., weight or pressure, and motion.

The weight, W, falling from the height, h, gives as the work $U = (Wh)$, composed of the two simple quantities W and h, entirely different in their nature, yet entering into the composition of the work U, in such a manner that one shall be the reciprocal of the other, like the two adjacent sides of a rectangle (which, by-the-by, affords the best illustration that occurs to me on the subject;) for, if *abcd*, fig. 2, be a rectangle, $ab = W$, and $bd = h$, the area of the rectangle $abcd = Wh$; or suppose ab = weight, to move parallel to itself from *ab* to *cd*, it would, by so moving, generate the rectangle *abcd*.

A slight knowledge of plane geometry shows that the area of this rectangle, *abcd*, may be equal in area to any other rectangle whatever, provided the sides are reciprocally proportional to the sides of the rectangle, *abcd*; or it may be equal to any description of superficies. So also may

$$Wh = \frac{m}{n} W \frac{n}{m} h,$$

but, as it is impossible for any superficial area to be represented by a mere line, so when $h = o$, then $U = Wh, = Wo, = o$, instead of W. In the concluding part of Mr. Smith's letter, there is an inadvertency which would lead to an erroneous conclusion. He says

$$\tfrac{1}{2}\frac{W}{g}v^2 = 1120 \times 16 = 17920 \text{ lbs.}$$

It should have been 17,920 dynamical units.

I am, Sir, yours, &c.,

WILLIAM DREDGE.

P.S. The Smiths are a numerous family. The gentleman referred to in my last letter, is Mr. W. H. Smith, of 4, Red Lion-square, Holborn. The gentleman referred to in this communication, is Mr. T. Smith, of Bridgetown, Wexford, Ireland.

London, 10, Norfolk-street, Strand, Febr. 16, 1849

DR. NEWINGTON'S HAND ROW HOE AND CULTIVATOR.

[Registered under the Act for the Protection of Articles of Utility. Dr. Newington, of Knole Park Frant, Tunbridge Wells, Inventor and Proprietor.]

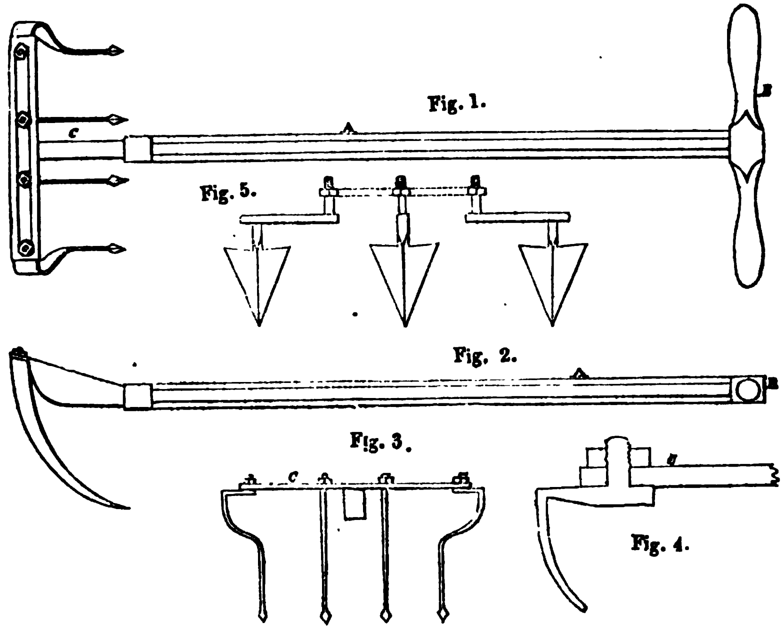


Fig. 1, is a plan of this implement; fig. 2 a side elevation of it; and fig. 3 an end elevation.

A, is the shaft of the implement; B, a cross-handle by which it is worked; C, a stock, or "backbone," as it is called by the inventor, which has a long slot in it, into which three, four, or more tines are inserted at distances apart corresponding with the width of the rows to be hoed, and made (temporarily) fast in the manner shown separately in fig. 4. The position of the tines being shiftable at pleasure, the same implement suffices for hoeing all sorts of crops, whatever may be the width of the rows, say from four to twelve inches apart. The force required to make the tines penetrate the ground, will of course vary with its stiffness, but is in light soils so slight, as to leave the labourer little more to attend to, than the guidance of the implement in a straight line.

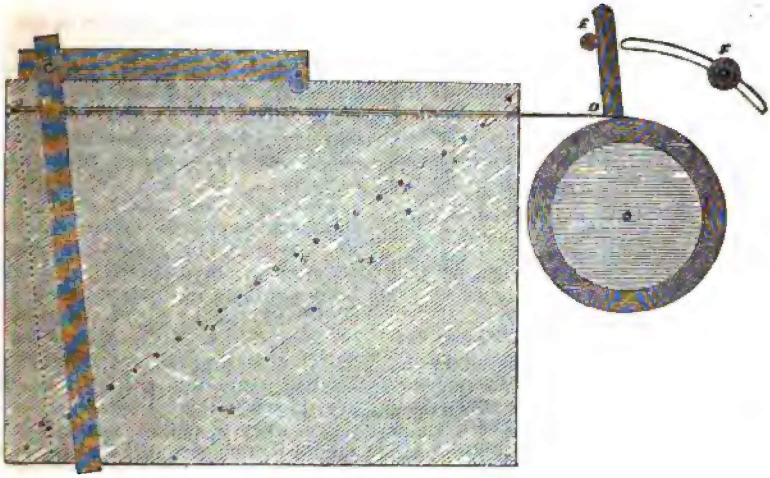
Dr. Newington, the inventor,* who is himself one of our most distinguished amateur agriculturists, bears the following testimony to the value of the instrument: "A man can do two acres a day with great ease; that is to say, stir and hoe five times for five shillings, much more effectually than by the present method of hand-hoeing, and at one-fifth the expense. It is astonishing the effects produced by this stirring and hoeing, and admitting the air into the soil; I consider it one of the most important operations in agriculture; and now I trust, that as an efficient implement has been invented for the purpose, farmers may be induced to adopt the system more generally. They would find that, by three or four stirrings, their straw would become like reeds, and the grain of better quality.—For carrots I have found the implement invaluable—nothing promotes the growth of this root so much as frequent stirrings, and I know from experience that by only stirring twice between the rows of beans, mangold, or turnips, even a stiff soil becomes mellow and completely pulverized."

By substituting for the tines, coulters, such as represented in fig. 5, this implement can be used for drawing out furrows

* The same gentleman is the inventor of an excellent Patent Hand Lever Dibble, and of various other useful agricultural instruments.

for carrots, parsnips, grain, &c. These furrow drawers can be fitted in the same way as the tines, and are stated to produce very clean work.

WHEEL-DIVIDING ENGINE.



Sir,—I have seen or read descriptions of various machines for dividing wheels to be cut into teeth; but I have not met with one which will enable a workman to set out a new number, not reducible to some other numbers already on his machine, without either a good deal of calculation, or by the tentative method of compass dividing, or making a new chuck. But it appears to me that the thing may be done perfectly, by a very simple and easily-constructed addition to machinery already in use.

In the above engraving the smaller circle represents the chuck which carries the wheel to be cut; and it turns on the same axis as the larger wheel, and is so connected with it, either by screws or ratchet, that it will turn through the same angle as the large wheel in one direction, but will stand still when the large wheel is turned in the other direction. This part of the machine not being new, I shall not describe it; and the problem is, to find a method of placing the stop F (which screws into the frame of the machine anywhere within the required limits,) so that while the handle, DE, of the wheel, moves from the fixed stop E to F, the wheel shall make $\frac{1}{n}$th of a revolution, n being the number of teeth to be cut.

Round the wheel is to be wrapped a string, or chain, which carries a pin or index at its end, running along a groove, or pipe with a slit in it, near the edge of a board, such as is shown in the engraving. In one revolution of the wheel the index is supposed to move from A to B, and to be at B when the handle of the wheel rests against the fixed stop. B, however, need not be a fixed mark on the board, but may vary with the length of the string according to its thickness, tension, &c. From A draw a straight line An in any direction on the board, or on a slip of metal fixed to the board, and divide it by small holes into as large a number of equal divisions, of any size you like, as is ever likely to be wanted. It may be convenient to draw several such lines, some divided into small spaces and some into large, for wheels of many and few teeth respectively.

To determine the place of F, for a wheel of n teeth: put a small pin, of the same size as the index pin, into the nth hole of the line *An*. Lay the edge of a parallel ruler of any kind against that pin, and the index pin at B: (probably a common bevel sliding along the edge of the board will be the best kind of ruler,) and so fix or adjust the other leg of the ruler (according to the kind you use,) that the ruling edge will move

parallel to the line *Bn*. Move it enough to allow the pin to be put in the $(n-1)$th hole, and hold or screw the ruler to the board with its edge pressing against the pin so placed. Then turn the wheel by the handle until the index touches the ruler at C, and screw the stop F into the frame, so as to touch the handle in that position.

Since AB = the circumference of the wheel, and BC : BA : : one of the divisions of A*n* : A*n*; or : : 1 : *n*, it is evident that while the index moves from B C, or the handle from E to F, the wheel will make $\frac{1}{n}$ th of a revolution: which is the thing required. I am, &c.,

E. R. DENISON, M.A.

42, Queen Ann-street, Feb. 16, 1849.

ROTARY AND RECIPROCATING ENGINES.

Sir,—Taking a deep interest in the subject of rotary engines, I have carefully considered the account of Davies's engine, which has appeared in some of the late numbers of your Journal, but am sorry to confess that I cannot concur in the high opinion which you and Mr. Dredge have expressed of the invention. The chief, or rather the only improvement I can discover in it, is in the means employed for preventing the escape of the steam between the sides of the piston and the ends of the cylinder, which I consider to be at once simple and efficient. But although this is an important point, as it obviates what has proved a difficulty in almost every arrangement of rotary engines hitherto attempted; yet I think the aim or objects sought for in rotary engines have been more fully attained in some prior inventions.

One of the chief objects proposed for attainment in rotary engines, is to avoid the loss of power and limitation of speed incident to reciprocating engines from the *vis inertia* of the moving parts, which must be overcome at each reversal of the motion of the piston. But to attain this advantage, it is not sufficient that the piston has a direct rotary movement—there should be no reciprocating movement in any part of the machine. Now, in Davies's engine, the steam stop or abutment has to be moved rapidly out and in at each revolution, and as it moves under pressure the friction must be considerable. Another principal object is to obtain a direct rotary action, without the assistance of a fly-wheel, and the power of starting the engine in every position of the piston, but in Davies's engine (that is to say with a single cylinder) when the piston is directly under the sliding abutment, the steam has no power to turn the piston in either direction, and a fly-wheel is required to carry the piston past that point. It is true that by employing a second cylinder with a piston set at an angle with the piston of the first cylinder, the fly-wheel may be dispensed with; but the same is the case in reciprocating engines.

Many previous rotary engines are free from one or both of these objections. For instance, in Galloway's engine, patented in 1826, to which Davies's bears a striking resemblance, there is no dead point, but the engine can be started in any position of the piston, and no fly-wheel is requisite, and although like Davies's there are sliding abutments, yet there was this advantage, that the slides, when in motion, were always in equilibrio, that is to say, the pressure on each side of the slide was equal, so that they moved with less friction.

There is another class of rotary engines in which a cylinder placed eccentrically within another cylinder so as to be in contact with the same at one point is caused to revolve by the pressure of the steam upon one or more rectangular pistons alternately projected from, and forced into the interior cylinder, and in some engines of this construction, neither valves nor fly-wheels are requisite. Lastly, in Avery's (Hero's) engine, the Disc engine, and Ericsson's rotary engine, there is no reciprocating movement in any of the parts of the engines—no dead points, no fly-wheels, and no valves.

As regards economy of space, I apprehend Davies's engine would occupy (with its fly-wheel) nearly, if not quite as much room as an oscillating engine making the same number of revolutions and consuming the same quantity of steam per minute, whilst the prime cost of the latter would, or should be less.

For the reason above given, I am with you in a little difficulty as to the "sufficient reasons" for the superiority claimed for Davies's engine, nor can I allow to your "GREAT FACT" the weight which you seem to attach to it—inasmuch, as various other rotary engines have been at work for much longer periods. A "Hero's engine" constructed by Staite,

has been for four of five years in operation at Saffron-hill; and I believe several others on the same construction in various parts of the country. A rotary engine was for several years in use at Lacy and Reynolds' gun manufactory, near Crosby-square, and I believe is so still, and several Disc engines have been in operation for varying periods, and flattering testimonials have been given of their performance. Upon the whole, therefore, whilst I regard the mode of packing the piston as an important improvement, yet, looking to the drawbacks I have pointed out, I question whether the invention will much conduce to the substitution of rotary for reciprocating engines.

I remain, Sir, yours, &c.,

A. Z.

February 19, 1849.

[As Mr. Dredge may be said to have constituted himself the champion of the rotary principle, we shall not interpose between him and the able antagonist who has here entered the lists against him, by offering any remarks of our own on the subject. We shall probably, however, take an opportunity before the discussion closes, to say something by way of separate justification of the part we have taken in the matter. Our earnest wish is to see the question of the comparative merits of rotary and reciprocating engines once more reinvestigated, and we invite all who can throw any light upon it, to lend their aid to the discussion. Authentic statements of the work actually done by other rotary engines will be particularly acceptable. —Ed. M. M.]

HARDY'S PATENT AXLE.

Sir,—As a recent decision of the Privy Council has conferred the signal favour of prolongation on Mr. Hardy's Axle Patent, and as a distinguished member of the House of Lords—a modern combination of Cicero the eloquent, and Cato the just—has graciously taken upon himself the office of Grand Trumpeter of this fortunate invention, and has launched the thunder of his wrath against the obtuse, whose minds have not yet been illumined with the same conviction as his lordship, I may, perhaps, be pardoned if I venture, through the medium of your Journal, to submit a simple question, which I should feel obliged, if Mr. Hardy, or the noble lord himself, would kindly answer.

I allude, as will be readily seen, to the speech reported to have been made by Lord Brougham, having for its object to assert the superiority of Mr. Hardy's axle over all others; to bear testimony to its miraculous strength and surprising economy; to proclaim the necessity of its general adoption; and, by way of climax, to denounce, as liable to the charge of manslaughter, all Directors on whose lines a fatal accident may henceforth occur, from the breaking of any axle not of Hardy's invention.

Now, I have since heard, from excellent—indeed, I am inclined to think unquestionable—authority, that on one line (at least), where an immense traffic gives continual opportunity of investigation, there is a patent axle employed, which is afflicted with the misfortune of continually breaking, and of which sometimes as many as three or four are fractured in one day. And the question which I have to ask is this: Whether Mr. Hardy, or any of his friends or advocates, has ever heard of the axle I allude to, and what the name of the patentee is?

That the shaft exhibited at the Privy Council did perform wonders, I do not doubt; but then it was, I presume, new and unused, and one that had not undergone the ordeal of a few months' service. It was a sample axle—no doubt, the very best of its sort; and, as such, it should not have been accepted as a practical test of the excellence of the invention, more than the lion can be cited as a proof of the strength of all quadrupeds, or the noble lord, whose capital letter to the Iron King found a place in your last Number, as an evidence of the abilities of all bipeds.

There are several other questions connected with this subject,—such as, whether the Hardy axle is really an economical one? whether a shaft deflecting from a straight line, in case of concussion, is not as dangerous as a fracturing shaft? &c., &c. But I shall be content if I obtain an answer to the single question I have before put.

If the Hardy axle be not the one to which I have alluded as having been found so defective in practice;—if that can be honestly and truly affirmed—let it be so; but should the reverse be the case, the question will then arise, whether the denunciation of manslaughter ought not rather to fall on those who *are* guilty of the employment of the Hardy axle, than on those who are not?

Trusting you will believe that no other motive, save an excusable regard for the general safety, dictates my troubling you with this letter,

I am, Sir, yours, &c.,

No Railway Director.

MESSRS. BEDINGTON AND DOCKER'S DOUBLE ARGAND LAMP.

(Registered under the Act for the Protection of Articles of Utility. Messrs. Bedington and Docker, of Birmingham and London, manufacturers, Proprietors.)

Fig. 1.

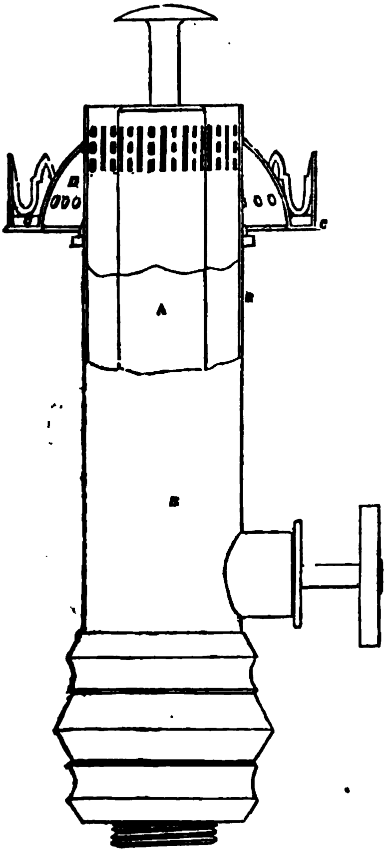
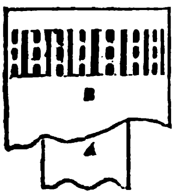


Fig. 2.



The present design furnishes a remarkable instance of the very slight alterations of structure on which great improvements frequently turn. An Argand lamp of the ordinary kind, which will not burn clearly for more than about eight hours, is made to furnish a brilliant light for nearly double the time by simply lengthening some of the parts about half an inch, and making a few apertures where this lengthening takes place.

Fig. 1 is an elevation, partly in section, of as much of an Argand lamp as is necessary to show these improvements. A is the central tube; B, the outer case (the space between A and B being that appropriated to the wick and oil;) and C, the glass holder or gallery, which has, as usual, a perforated air cone, D, in the centre of it. The central air tube, A, instead of terminating, as usual, on a level, or nearly so, with the top edge of the gallery cone, D, is carried about half an inch higher, and is made at top with apertures, as shown in figure 1. The outer case, B, is also prolonged at top to a similar extent with the central air tube, A, and made with apertures, in the same manner at top, as shown separately in fig. 2. By thus increasing the height of the central and outer tubes, and perforating them at top, currents of air are directed through the apertures into the wick, just below the point of inflammation, which serve to prevent the oil from becoming thickened or carbonized there by excess of heat (the usual cause of the rapid fouling of the wick, so much complained of), and thereby enable the lamp to burn for a much longer period, with undiminished brilliancy.

SAFETY CARRIAGE.

[Registered under the Act for the Protection of Articles of Utility. W. Burbury, of Clarence Villa, Leamington, Esq., Inventor and Proprietor.]

Fig. 1, is an elevation of a gig fitted with the very efficient safety apparatus, which forms the subject of this design; and fig. 2 is a plan of the same with the body of the gig removed. A A, is a central or draw-bar which is firmly attached to the axle, B, and passes horizontally over the body of the horse, being a few inches higher, so that it may not come in contact with his back. To this bar, A, there is attached a transverse bar, C, the two ends, C′C′, of which are turned downwards, and are fixed to the shafts, DD. At their lower ends they carry the wheels, EE, which support the whole weight of the front carriage, and at the same time prevent th e

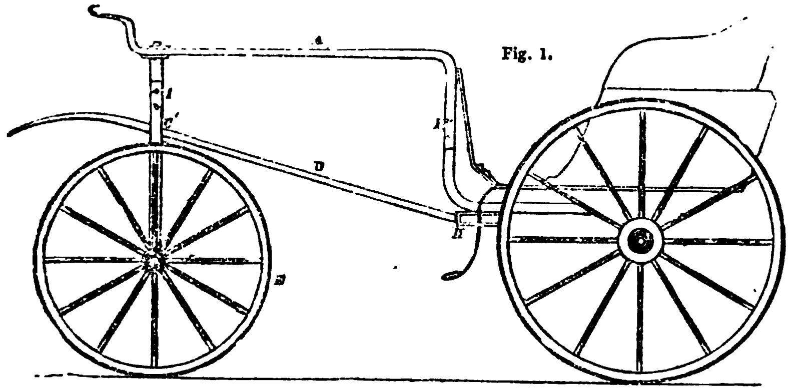
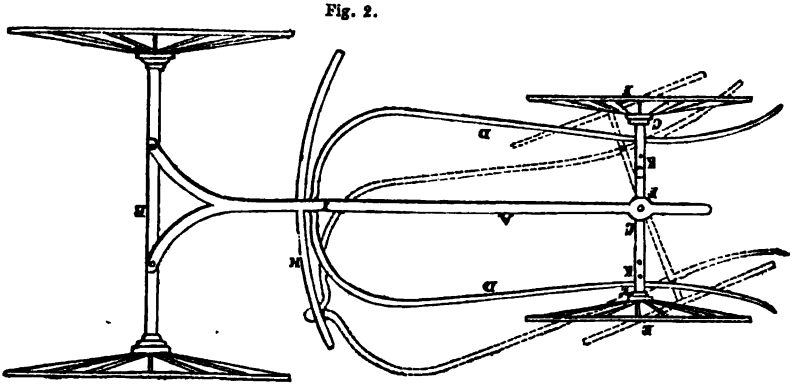


Fig. 2.



horse, if made by any chance to stumble or slip, from falling. The transverse bar, C, is jointed to the central bar, A, at the point F, so that, in turning, the front wheels and shafts assume the position shown by the dotted lines in fig. 2. H, is a slotted segmental guide, which carries the back end of the shafts.

The upright pieces, C′C′, of the transverse bar, as also of the longitudinal bar, A, are made capable of being lengthened or shortened to suit the height of the horse, which is accomplished by means of slots and fastenings placed at I I I. The distance between the shafts can also be increased by similar fastenings at KK, so that two horses may be put in the shafts.

DISINFECTION OF CLOTHING. BY MESSRS. DAVISON AND SYMINGTON'S PATENT PROCESS.*

The absorption of noxious effluvia by clothes or soft and porous articles of merchandise, has been long recognized as a fact by men who have directed special attention to this subject. * * *

The use of the various liquid disinfectants, which have of late been proposed, is not applicable to articles of clothing; and the common practice of baking clothes in ovens is liable to lead to their destruction, owing to the impossibility of regulating the temperature to which it is necessary to expose them. The only plan which combines economy with certainty of disinfection, is that which has been patented by Messrs. Davison and Symington, and which is now extensively employed in various manufactures. This plan consists in exposing the articles of clothing in a large chamber to rapid currents of air, heated to a temperature insufficient to injure them—*i. e.* varying from 200° to 250°. We have had an opportunity of witnessing this process as applied to certain branches of manufacture, and the results were of the most satisfactory kind. In the

* For the specification of this process, see *Mech. Mag.*, vol. xlviii., p. 457.

case of infected clothing, it is obvious, that while a high temperature tends to destroy the animal poisons, a rapid current of air, constantly passing through the chamber, tends to carry them off. The temperature of the current of air can be so regulated that common albumen is speedily dried into a yellow transparent solid, without coagulation; or, if necessary, the heat may be increased to 400° or 500°, according to the nature of the articles which are exposed. Dr. Copland has already directed the attention of the profession to this process,* and observes that—"The great advantage of this method is its easy applicability to all kinds, and to any number of objects and articles without injury to their textures or fabrics." From an inspection of one of these chambers, when the temperature of the current of air was 116°, we can state that the process of Messrs. Davison and Symington, for the drying and disinfecting of the clothing of cholera and fever patients, will be far more efficacious than the common plan of washing and baking. In our opinion, an apparatus of this kind, fitted up in large hospitals, infirmaries, prisons, and workhouses, as well as at all quarantine stations, would be admirably adapted to prevent the diffusion of infectious diseases. We trust that this subject will receive the attention of the Board of Health.—*London Medical Gazette.*

* Dictionary of Practical Medicine. Part XI., page 245.

REMARKS ON SERIES. BY PROFESSOR YOUNG, BELFAST.

In my article on this subject, in the last Number of the *Mechanics' Magazine*, just received here, I find that there are two slight errors at page 153. In the first column, line 9 from the bottom, a should be a^2; and in the expression opposite to this, b^2 should be b. In the proposed hypothesis, that $a^2=b$, the roots of the quadratic are imaginary; and it might be thought that we are at liberty to infer this circumstance from the divergent character of the series: but the divergency exists whether b be positive or negative, in which latter case the roots are real.

It may be proper here to add, that I do not regard a series as divergent, simply because its sum is infinite; although, I believe, such is the doctrine held by all writers on the subject. In strictness, a series cannot be asserted to be divergent when, after n terms, it ceases to be accumulative, though n be infinite; for, in such a case, the generating function, whenever such can be exhibited, would be accurately equivalent to the infinite series, which it never is in a diverging series. But this is a point which I have more fully insisted upon elsewhere.*

In the article referred to, I noticed the objections to the rules given in books on algebra for the summation in recurring infinite series: the same objections apply to the method of summation by continued fractions; and, indeed, it is plain, that for any infinite diverging series, no expression whatever can be properly assigned for its sum; nor is it possible to convert such a series into another that shall be convergent, although this is often stated to be practicable by Euler's differential theorem, and by other methods. We thus see the propriety of the doctrine held by the modern continental analysts, namely, that "divergent series have no sum," although most of these writers, and among them the illustrious Abel, commit the error of supposing a series with an infinite sum to come within the category of divergent series; whereas such a series, when, after an infinite number of terms, it ceases to be accumulative, may be accurately expressed by its generating function.

Belfast, February 19, 1849.

* Transactions of the Cambridge Philosophical Society, vol. viii., Part IV.

REVOLVING FURNACES.—GRIST'S—JUKES'S.

Sir,—For several weeks past I have been turning my attention to the improvements in furnaces, being anxious to apply one of the best principle under a steam boiler I have in use.

From your opening remarks on Grist's patent revolving furnace, in your publication of the 3rd of February, I felt assured that I had at length found something new and superior in principle. But I regret to say, that upon perusing the article, I was quite disappointed, and, instead of finding anything *new in principle*, I find nothing but the principle of Jukes's furnace proposed, viz., a *travelling surface of fire bars*, carrying the fuel from the front to the back of the furnace—the fuel being supplied by a hopper in front, with an adjustible sliding door to regulate the supply of fuel to the furnace, the bars travelling at such a rate,

and the fuel being supplied in such proportion, as to allow the coals to be carbonized to a certain extent near the mouth of the furnace. The gaseous matters emitted during such carbonization having to pass over the intense burning mass of fuel, necessarily become ignited, and, consequently, there is a saving in fuel and effectual consumption of the smoke. *This is Jukes's principle, and nothing more in principle does Mr. Grist propose to carry out.*

The only novelty which is proposed is in the fire bars, and the means of making them revolve. These are alterations, it is true; but such clumsy variations from Jukes's arrangement have evidently been made with the express intention of avoiding Jukes's patent. To me it appears the ingenious inventor has been unfortunate enough to substitute an arrangement *more complicated in detail, far more liable to get out of order*, and, as regards *preventing the accumulation of clinkers, certainly not so effective.*

Jukes's fire bars are an endless chain of bars, about half an inch thick, revolving in a line with their length, and so connected together, that in passing over the drums, *they break joint throughout their whole length and breadth*, and, to a certainty, throw off any clinkers that are formed upon them. This is certainly one of the best features in the invention. *The cleansing of the bars is a self-acting motion.*

In Grist's, the bars are cast in sets of four, presenting a large surface, in which *no breaking of joints take place*; consequently, each set of bars would carry over with it, whatever clinker might form upon it. Such clinkering would communicate to the slots or grooves in the side frames, through which the ends of the fire bars have to travel, and, consequently, *the whole series of fire bars would be liable to set fast.* Such sets of fire bars, moreover, being cast together like a frame, would be very liable to warp from unequal expansion, and would consequently produce great friction in the slots through which their ends travel, if they did not entirely set fast. As to using such bars singly, there would be no certainty of their travelling at all—they would get a twist in the furnace.

As to the impediments the rollers present to the free action of the air in Jukes's furnace, it will be found that if the area they occupy be deducted from the total area underneath the fire bars, at least fifty times as much area will remain as will be found in the necessary ventage between the fire bars.

Hollow water bridges I can recollect being applied fifteen years back. Jukes has used them during the last four years.

Since writing the above, I have called at Jukes's, and have received from them some of their prospectuses, one of which I send you. Perhaps it may alter your opinion as to Mr. Grist's furnace being the best of its class that you have seen.

If these remarks do not occupy too much space, I think in common fairness you ought to publish them in your Journal, to prevent the public being misled on a subject of so much importance.

Your obedient Servant,

A. W., Engineer.

Note by the Editor.

In our account of Mr. Grist's "revolving furnace" we described it expressly as being "the best of *its class*," and free from some of "the greatest practical objections usually urged against furnaces" of *that class*. We did not claim for it anything "new in principle;" and all that our correspondent observes on this head is therefore without any application. Neither is it correct to say that the employment of "a travelling surface of fire bars" is "Jukes's principle," or covered by "Jukes's patent." The same principle—or contrivance rather—was thus clearly described by the ingenious Mr. Bodmer, in the specification of a patent dated May 24, 1834, which was four years prior to Mr. Jukes's first appearance as a furnace reformer. "A propelling or travelling grate may be constructed by a series of fire bars attached to an endless chain passed over conducting rollers, and actuated in any convenient manner; or the frames of fire bars or grates, above described, may be connected by hooks or latches one to the other, and be drawn through the furnace instead of being propelled in the manner above described." Mr. Bodmer's patent has expired, so that whether he was the first inventor of the travelling grate or not (our impression is that he was), it is now common property, and Grist is as free to use it as Jukes, and much freer than Jukes was to do so in 1838, at which time Mr. Bodmer's patent was still in full force. Our correspondent thinks the "free action of the air in Jukes's furnace" all that need be desired. We can only say that we have known it to be repeatedly objected to on this ground; and this much at least is certain, and not disputed, that there is a much freer course for the air in Grist's than in Jukes's. The objections to Grist's bars on the score of liability to clinkering are deserving of his attention; but they may we think be easily removed. "Hollow water bridges" are no doubt of old date; but not so, bridges "connected by two sets of pipes with the water

spaces in the boiler" (whereby a constant circulation is kept up within), and it is this peculiarity alone which Grist claims. Of its usefulness there can be no question.

THE PESTH SUSPENSION BRIDGE.

Sir,—It is not stated in the notice of the suspension bridge at Pesth whether the military marched over in regular step or in disorder. A knowledge of this point would be interesting. There is generally an apprehension of subjecting suspension bridges to this trial.

If the military went over in an irregular mass the weight would be by no means excessive; neither is it the first suspension bridge which has been subjected to the test of supporting a military train. Bridges erected on my father's plan have been subjected to a similar test. Baggage wagons and artillery trains may pass over with impunity, but I should not consider it prudent to allow infantry in step to do so.

Not a great while ago the official referees were very desirous of proving a bridge I have erected at Shadwell, by marching a body of infantry in quick step across it. I objected to this, because I could not tell what effect the regular tread of so many men might have—but I had no objection to having ten times the number passed over in irregular order. It was subsequently tested with stone. You gave a description of the bridge some time since, (vol.xlix.,p.356.) The iron work was manufactured by Messrs Joyce and Co., of the Greenwich IronWorks.

I certainly should be glad to know if the infantry marched in step across the Pesth-bridge, and if any of your foreign correspondents could settle this point for me I should feel obliged.

I remain, Sir, yours truly,
WILLIAM DREDGE.

London, 10, Norfolk-street, Strand,
February 16, 1849.

MR. HEWITT'S LOST PATENT.

Sir,—No. 1332 of the *Mech. Mag.*, for February 17, has just been put into my hands, and in it, is an Editorial note appended to an abstract of a specification of a patent, which requires some remark. Without referring to the details in question, I have simply to state that the rough particulars and drawings of the invention were not put into the agent's hands until a few hours before the latest possible period for despatching the completed specification to the Enrolment Office. You will at once see the impossibility of drawing a regular business-like specification in the time thus allowed, and the matter was only undertaken at the earnest solicitation of the patentee. All that could be done in the limited time, was done, and abundant evidence exists to prove the sole and undivided culpability of the patentee himself.

With the remarks relative to the Editor of the *Glasgow Mechanics' Magazine*, I have nothing to do; but lest any one should apply them to the writer of this note, it may be here stated, in order to prevent mistakes, that the (*London*) *Mechanics' Magazine* is not entirely blameless in the way of "unacknowledged appropriations" from this Journal.* Of future instances, due notice will be given.

I am yours most obediently,
THE EDITOR OF THE PRACTICAL MECHANICS' JOURNAL.

Practical Mechanics' Journal and Patent Office,
33, Buchanan-street, Glasgow,
February 20, 1849.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING FRIDAY, FEBRUARY 23.

THOMAS DE LA RUE, Bunhill-row, Middlesex, manufacturer. *For improvements in producing ornamental surfaces to paper and other substances.* Patent dated August 15, 1848.

The iridescent colours peculiar to thin plates of glass, soap bubbles, and other filmy substances—known by the name of "Newton's Rings," from having been first investigated by that great philosopher—are familiar to every one. Of the same class of phenomena are the beautiful tints exhibited by steel when raised to any temperature below red heat, and by polished iron when immersed in a solution of acetate of lead, and connected with the positive pole of a galvanic battery, while the wire of the negative pole is dipped into the solution; the effect resulting in the one case from a slight oxidation of the metal, and in the other from its being coated with the peroxide of lead. In like manner a variety of colours are produced in the Daguerreotype process by the vapour of iodine or bromine acting upon the plate of silver.

The present invention consists of a very ingenious application of these facts to the embellishment of paper and other similar substances. The article to be ornamented is placed in a shallow open vessel, with the surface to be covered by the film uppermost. This vessel is filled with clear water to about four inches above the article, and then a spirituous solution of some resinous substance, or some balsam, is added, in sufficient quantity to cover the water with a thin film possessing the iridescent colours peculiar to such bodies. When the solvent has evaporated, and the film has become dry and pliant, the article is gradually lifted out of the water in a sloping position, to allow the water to escape from between the surface and the film, which leaves the iridescent film permanently attached to the article, which is then placed on a sloping board to

*[We challenge the writer to produce a single instance of the sort.—ED. M. M.]

dry. When the surfaces are irregular, or in basso-relievo, the article is placed in a perforated false bottom with handles, and lifted out in an inclined position. And when the article is a statue, or other figure in the round, it is suspended to a wire, and made to rotate while being withdrawn from the water. Instead of the article being withdrawn, the water may be run off at bottom. A variety of tints may be produced by allowing the varnish to fall in drops upon the surface of the water, and combining them together by curling them with a comb; or by carefully withdrawing a portion of the film towards the sides of the vessel with a spatula. In order to make the varnish run more easily upon the surface of the water, it is proposed to mix an essential oil with it. The patentee states that he prefers to employ clear water as a medium, and hard white varnish, mixed with an equal portion of spike lavender oil. A dark surface is stated to be susceptible of producing a better effect by being thus ornamented than a fine white one.

Claim.—The mode of ornamenting the surface of paper or other substance by iridescent films.

MOSES HYAM PICCIOTTO, of Finsbury-square, London. *For a method or methods of purifying and decolorizing certain gums.* Patent dated August 17.

The gums upon which it is proposed to operate, are the varieties of gum Arabic and gum Senegal; and the modes of purifying and decolorizing them are as follows:—

1. The patentee prepares a solution of purified sulphurous acid gas, in which he dissolves the gum, taking care to exclude the atmospheric air as much as possible. The earthy and ligneous matters fall to the bottom, and the colouring matters combine with the sulphurous acid gas; the carbonic acid gas is driven off by the application of heat; and some salifiable base, such as carbonate of baryta, is introduced, with which the acid combines, and forms an insoluble salt, whereby it is neutralized. The solution is then filtered through pure gelatinous hydrate of allumina, or through unglazed earthenware, and wholly or partially dried by the application of heat to it, in open pans, or in vacuum pans (and stirred by agitators to prevent burning), according to the consistency required to be given to the gum. When it is desired to obtain a very white kind of gum, the acidulating process is repeated as often as required.

Or, instead of dissolving the gum in a solution of sulphurous acid gas, it may be dissolved in water, which is afterwards to be impregnated with sulphurous acid gas. The proportion of gum to the solution is one part, by weight, of the former to from six to twelve of the latter, according to its strength.

2. The gum may be dissolved in water, and mixed with gelatinous hydrate of allumina, alone or combined with pipe-clay, and then filtered as before. The allumina is washed in warm water, to separate it from the gum, and afterwards with a solution of chlorine or chloride of lime, to free it from the colouring matters.

Claims.—1. The decolorizing of gum Arabic and gum Senegal by a solution of sulphurous acid gas, however generated, purified, or applied.

2. The decolorization of gum Arabic or gum Senegal by gelatinous hydrate of allumina, alone or mixed with other substances.

3. The mode of purifying gum Arabic or gum senegal, combined with the process of decolorization.

4. The mode of purifying and recovering the gelatinous hydrate of allumina.

THOMAS WARREN, Montague-terrace, Mile-end Road, gentleman, and WILLOUGHBY THEOBALD MONZANI, James-terrace, Blue Anchor-road, Bermondsey, gentleman. *For improvements in the construction of bridges, aqueducts, and roofing.* Patent dated August 15, 1848.

The specification of this invention exhibits four different modes of building bridges, which it is stated may, with some slight modifications, be applied to the construction of aqueducts and roofing.

1. The bridge is built with cast iron side bars, rods, or plates, inclined towards each other, and combined so as to form a series of vandykes. They are bolted at top to horizontal compression rods, and at bottom to horizontal tension rods, and carry a roadway at top or at bottom, or at both.

2. Or the bridge may be built of cast-iron side angular frames (placed with the apices downwards), which have their bases bolted together, end to end, and their apices bolted to horizontal rods.

3. Or, instead of the preceding modes of longitudinal construction, hollow cast-iron transverse frames may be employed, which are inclined, and bolted together at top, and are similarly attached at bottom to horizontal rods, bars, or plates.

4. Or wrought iron side rods may be bolted at top to compression rods, and at bottom held together by the side of wooden girders, and the structure strengthened by means of stay rods. The angles of the plates are regulated by longitudinal screw rods and nuts.

Claims. — 1. The mode of constructing bridges, aqueducts, or roofing with iron rods, bars, or plates, inclined towards each other, and connected together at top by compression bars, and at bottom by tension bars, so

as to carry a roadway at top or bottom, or at both.

2. The mode of constructing bridges with cast iron angular frames bolted together at their bases, and having their apices bolted to horizontal compression rods.

3. The mode of constructing bridges with transverse hollow cast iron frames inclined towards each other, and bolted together at top and at bottom to horizontal plates.

4. The mode of constructing bridges with wrought iron rods inclined towards each other, and attached at top and bottom, as described.

William Galloway and John Galloway, Knott Hill Ironworks, Hulme, Manchester. *For certain improvements in steam engines.* Patent dated August 17, 1848.

These improvements refer,

1. To certain arrangements of the second or high-pressure cylinder in compound or double-cylinder steam engines.

2. To an arrangement for causing the cam or valve-shaft to rotate without toothed gearing.

3. To the apparatus for working and regulating the action of the expansion valves.

4. To the application of an additional exhaust valve or valves to the condensing cylinder.

5. To a new mode of heating water by the application of wasté steam in its passage from the condensing cylinder.

6. To a mode of constructing pistons, pump-buckets, and the foot and delivery valves.

7. To a mode of generating steam; and

8. To a steam gauge:—

1. The high-pressure cylinder is placed exactly over the air pump—the length of the stroke of the one being equal to that of the other, and the piston rod is passed through the piston and the bottom of the cylinder, and attached to the plug rod of the air pump, while it is connected by the back links of the ordinary parallel motion with the beam, whereby the use of additional back links is dispensed with; or the piston rod may be connected to the plug rod by crosshead and side rods. Or, instead of the cylinder being fixed, it may be vibratory or oscillating, and have the piston rod connected directly, or by means of gearing, to the crank of the main shaft, or to a second crank fixed upon it. The steam, when it has completed its work in the high-pressure cylinder, passes to the condensing cylinder.

2. Two eccentrics are keyed at right angles upon the main shaft, and are connected by rods to corresponding cranks on the cam rod, whereby it is made to rotate with the main shaft, and to work the valves.

3. The expansion valve-spindle is connected by a crosshead to a vertical rod, which is attached to a lever weighted at the other end. A cam keyed upon the valve shaft causes the lever to rise and fall, and thereby to work the expansion valves. The arrangement for regulating their action is as follows:—The lever is supported upon a carriage, and is free to travel to and fro from the cam. On one side of the carriage is a walking lever, which is attached to a short bar jointed to a vertical rod, which is connected by a crosshead to the piston rod of a small cylinder. An air-blast cylinder, worked from the main shaft, drives a current of air into a receiver furnished with a regulating escape cock. The air in excess passes under the piston of the small cylinder, thereby elevates the piston rod, depresses the vertical rod, and, through the medium of the short bar and walking lever, causes the carriage, and consequently the lever whereby the expansion valve is worked, to travel from the cam. It will be seen that the distance the lever travels is regulated by the blast, which depends upon the speed the engine is made to work at, and that the action of the expansion valves is regulated accordingly. Or the weighted lever may be carried upon a screwed rod, worked by mitre and bevelled wheels, from the piston rod of the small cylinder, through the intervention of the connecting rods, as before.

4. Additional exhaust valves, inclosed in suitable boxes, are attached to the top and bottom of the condensing cylinder, and open into a passage which leads to the condenser.

5. The water to be heated is supplied from the hot well or other source of supply to a suitable vessel, and the steam, after having performed its work in the condensing cylinder, is caused to pass through a series of horizontal pipes, or coil of pipes, placed within it; or the steam may be exhausted from the condensing cylinder by a double-acting pump, and driven into a vessel wherein a broken stream of water is caused to fall upon and mingle with it. Or the steam may be exhausted into a vessel through a tube fitted with a clack valve; over this tube is a cup dipping into the water in the vessel, and fitted with two clack valves, above which the water is made to fall in a shower. When the cup is raised, a vacuum is created underneath, into which the steam rushes through the clack valve of the tube. When the cup is forced down, the clack valve of the tube is closed, and those of the cup opened, through which the steam passes into the vessel, where it encounters and heats the shower of water.

6. Behind the metallic packing rings of the piston is placed a ring of vulcanised caoutchouc or other suitable material; and

two valved passages are placed in the top and under surfaces of the piston, whereby, as it is forced up or down, the steam is admitted behind the vulcanised caoutchouc ring, against which it presses, and consequently keeps the packing rings in close and constant contact with the interior surfaces of the cylinder. The same arrangement is applied to pump buckets, and water admitted behind the ring instead of steam. Tubes or washers of any suitable elastic material may be substituted for the ring. Instead of using heavy metal plates for valve flaps, it is proposed to make them of vulcanised caoutchouc or other suitable material.

7. The improvements in generating steam consists in placing the fire inside instead of underneath the two under cylinders of the French boiler. These cylinders are surrounded by water contained between them and their outer casings. The legs which support the top cylinder upon the two under cylinders are made hollow, so that free communication is established between all three.

8. Upon the piston of the steam gauge is a rack that gears into a pinion keyed upon a spindle, which carries a hand. The rack presses at top against steel springs or rings of any suitable elastic material calculated to offer a certain known amount of resistance to its upward motion. As the pressure of the steam underneath the piston increases, the rack will be forced upwards, and the axle made to rotate, whereby the steam pressure will be indicated by the hand upon the face of the dial.

Claims.—1. The arrangements of the high pressure cylinder in compound steam engines.

2. The peculiar arrangement for causing the cam or valve shaft to rotate without toothed gearing.

3. The mode of working and regulating the action of expansive valves.

4. The application of additional exhaust valves to the condensing cylinder.

5. The mode of heating water by waste steam.

6. The method of constructing pistons, pump buckets, and the foot and delivery valves.

7. The mode of generating steam.

8. The improved construction of steam gauge.

Edwin Thomas Truman, 40, Haymarket, London, dentist. *For an improved method or methods of constructing and fixing artificial teeth and gums, and of supplying deficiencies in the mouth.* Patent dated August 15, 1848.

The patentee first takes a cast of the mouth in plaster, which he hardens with resin, and then constructs a corresponding metal frame of gold wire, having pegs to which the teeth are attached. The frame is covered with gutta percha, which is drawn round the teeth so as to form sockets for them, and then pressed, while in a warm and plastic state, into the mould, which has been previously wetted, The gutta percha is moulded into form to supply the other deficiencies of the mouth, either by reheating or by hot instruments. It is then withdrawn, the teeth lifted off the pegs and out of the sockets, the interior surfaces of which, together with those of gutta percha not intended to come into contact with the gums, are electrotyped. Finally the teeth are fastened on the pegs and in the sockets by cement. The gutta percha mould will, it is said, fit the gums so accurately as not to require other fastenings, although, if desired, such fastenings may be used.

The second part of this invention consists in electrotyping hard wax or other soft substance used in supplying the deficiencies in the mouth, in order to prevent their being effected by moisture.

Claims.—1. The constructing of artificial teeth and gums with gutta percha, and electrotyping it.

2. The coating of soft substances used to supply the deficiencies of the mouth with metal.

Isaac Taylor, Stamford Rivers, Essex, gentleman. *For improvements in preparing and engraving surfaces; also in the construction of cylinders adapted for engraving, and also in machinery for ornamenting surfaces.* Patent dated August 21, 1848.

This invention consists, 1. In arranging a number of hinged rhomboidal frames or pentagraphs in a series, so as to obtain what the patentee terms a "high diminution" in transferring the design from the original to the surface to be engraved. 2. In combining a number of pentagraphs in pairs, back to back, and connecting them by a transverse bar, so that the same design may be transferred to two separate surfaces at the same time. And 3. In an arrangement of apparatus, in combination with the pentagraph, for transferring the design to the surface of a printing cylinder.

The patentee does not confine himself to the details given in the specification, so long as the peculiar character of his invention is retained.

John Bethell, Parliament-street, Westminster, gentleman. *For improvements in preserving animal and vegetable substances, and also stone, chalk, and plaster, from decay.* Patent dated August 21, 1848.

The wood or timber to be prepared for building purposes by drying or by drying and smoking, is placed in a chamber built of iron or brick, which is furnished at top with a pipe leading to an exhausting apparatus. The flue leading from the furnace is placed in the bottom of the chamber, and perfo-

rated to allow the heat and smoke to pass to the wood. The exhausting apparatus is made to withdraw the moisture and carbonic acid gas from the chamber, and to create a draught from the furnace into it. The furnace may be fed with coke or other fuel, and the smoke increased by bark or other antiseptic material being mixed with it. Or steam, which has been dried by being made to pass through red hot metal tubes, may be employed, and caused to pass through some antiseptic material prior to its entry into the chamber, in order that the wood may be impregnated with it. In the case when steam is used as the drying and impregnating medium, the chamber is provided with a stop cock for the admission of atmospheric air to regulate the temperature of the steam. When the pieces of wood are small, they are placed in a pressure tank (for which a patent was obtained by Mr. Bethell, July 11, 1838), filled with any of the following antiseptics:

1. Bituminous or tarry oils, produced by the distillation of bitumen, or bituminous shale, sand, or stone.

2. The bituminous and pitch oils, made according to the method patented by S. Cliff, December 8, 1846.

3. The oils resulting from the distillation of tar or bitumen, especially the heavy oils of coal gas tar.

4. Petroleum, or native mineral oil.

5. The oil resulting from the distillation of rosin.

6. Any combination of any of these oils.

7. Rosin melted and thinned with any of these oils.

8. Sulphur mixed with one of these oils, in the proportion of 1 lb. to 1 gallon.

9. Rough pyroligneous acid.

10. Pyro-acetate of copper.

11. Solution of bark, which last two are stated to be applicable of preventing the ravages of the sea worm.

The grain or seed to be preserved is fed from a hopper into a square box, where it is received upon a horizontal endless band, which travels from left to right, and drops the grain on to another endless band placed under the first, and travelling in the opposite direction. The grain is carried to and fro on a series of endless bands successively, until it reaches the last or bottom one, which delivers it outside the box into a suitable receptacle. The steam is admitted into the box through an aperture in the bottom; and the number of endless bands may be varied as required. To preserve meat, it is proposed to inject all the arteries, as soon as the animal is killed, with wood naphtha or pyroligneous acid, mixed with brine, by pumping it into the main artery. The meat is then packed away in casks filled with brine, or it may be packed in suitable vessels capable of bearing a pressure of 60 lbs. to the square inch, and charged with carbonic acid gas.

To preserve refuse animal matter or fish, in order that it may be kept from putrefaction until wanted for manure, it is steeped in a mixture of pyroligneous acid and salt solution, then dried and ground up, after which it is mixed with any suitable material, and is ready for use. Malt liquors or wine may be preserved for a longer time than usual by charging them with carbonic acid gas in peculiarly shaped vessels, which permit of their being drawn off as wanted without injuring their flavour. And milk or cream may also be made to keep sweet for any length of time by impregnating it with carbonic acid gas.

To preserve porous stones, chalk, or plaster, the article is steeped in either of the antiseptics given above, and then polished or painted.

Claims.—1. The mode of preparing wood by drying, or by drying and smoking.

2. The use of anhydrous steam for drying and preserving wood, in combination with the antiseptic materials.

3. The application of anhydrous steam to grain, and the machinery employed therein.

4. The employment of the antiseptic materials for preserving wood.

5. The employment of wood naphtha or pyroligneous acid mixed with brine, for the preservation of meat, or refuse animal matters for manure.

6. The method of preserving porous stones, chalk, and plaster.

7. The mode of preserving malt liquor or wine by impregnating it with carbonic acid gas in peculiarly shaped vessels.

8. The preservation of milk or cream by impregnating it with carbonic acid gas.

William Young, Queen-street, Cheapside, lamp manufacturer. *For improvements in closing spirit and other cans or vessels.* Patent dated August 21, 1848.

The various improvements of which form the subject of this patent are as follows:—

1. The ordinary camphine can is constructed with a neck, which is enlarged at top, and screwed on the outside. The stopper, which may be of cork or any other elastic material, is placed in the enlargement so as to rest upon the neck of the can, against which it is kept tightly pressed by a cap that screws on to the outside of the enlargement of the neck. The top of the cap is perforated to allow of the stopper being seen beneath.

2. Or the cork may be held tightly against the neck of the can, or bottle, by a metal disc, which is bent into a conical shape;

and then put on the top of the cork, and pressed down flat, whereby its edges are made to take into a groove in the inside of the enlarged part of the neck.

3. The case or vessel for containing the cans is furnished with a bracket that carries a short screw-rod. In the cover is a nut which is screwed on the inside, and loosely held so as to allow of its being turned round by a key, by which, when the cover is shut down, the rod is screwed into the nut. The space above the nut is filled-in with wax up to the level of the lid of the cover, and sealed to prevent its being opened without detection.

4. The space between the tube and the glass vessel containing the camphine or other fluid, is made fluid tight by the following arrangement: The tube is fitted with a collar, which rests upon the inside of the vessel round the bottom of the opening, through which the rest of the tube passes. The lower part of the tube is screwed on the outside, and carries a nut. Between the nut and the bottom of the glass vessel is a cork collar, which when compressed by the nut being screwed up, keeps the space perfectly fluid tight.

It is proposed:—

5. To make the stoppers with a centre of wood, or other suitable material, encircled with a cork ring, and cemented together.

6. To close bottles by a cap having a cork ring cemented to the inside of its rim.

7. To make a hole laterally through the neck of the bottle (intended to contain aërated liquids) in which the stopper is to be held.

8. To unite gas pipes, by employing a cap similar to No. 1, to close one of the pipes, and which, as well as the cork, are pierced to allow the second pipe to pass through; whereby a sliding gas joint is obtained.

9. To connect glass pipes by means of a cork ring placed between the inner and the outer pipes, and securely held together by pegs passing from the outer pipe through the corking to the recesses in the inner one.

10. To compress and roll the corks in a machine, which consists of a bed-plate, fitted at one end with an upright carrying the bearings of a vertical friction roller that is capable of being adjusted by a thumb-screw to any distance from the bed-plate. The top plate is fitted with a handle, by which it is moved backwards and forwards under the friction roller.

Claim.—The arrangement and combination of parts, as separately described.

RICHARD SHAW, Gold's-green, West Bromwich, Stafford, railway-bar finisher. *For improvements in the manufacture of iron into tyre bars, round bars, square bars, and flat bars; T bars, angle iron and trough iron.* Patent dated August 21, 1848.

The invention sought to be secured under this patent, consists in employing curved bars to form the outsides of the piles out of which the angle iron or trough iron, tyre bars, flat bars, round bars, and T bars are to be rolled, in order to prevent their lamination. The bars are rolled into the required curved shape by suitably grooved rollers.

Claim.—The application of this principle to the piling of iron for the formation of the different kinds of iron before named.

THOMAS RICHARDSON, Newcastle-upon-Tyne, chemist. *For improvements in the condensation of metallic fumes, and in the manufacture of white lead.* Patent dated August 21, 1848.

This invention consists,

1. In submitting melted tea lead to the action of a slow current of hot air in a red lead chamber or iron pan, whereby the tin is caused to separate from it, and float upon the surface, together with a variable quantity of oxide of lead. The tin and oxide of lead are removed, and the tea lead is reduced to a granulated state, or into crystals, by the crystallizing process of Mr. Patterson, and damped with nitric or acetic acid of commerce, or acetate of lead diluted with water until of the same strength. The tea lead is then placed upon a series of shelves fitted into a suitable frame, and closed by doors. The shelves are heated by steam, or hot air being admitted into the spaces underneath each shelf, and carbonic acid gas is caused to flow into and upon the tea lead. The heat is kept up, and steam occasionally admitted to the tea lead. At the expiration of about fourteen days, it is removed to a dolly tub, where the white is separated from the metallic lead, and the latter returned, with a fresh supply, to the shelves.

2. The arrangement for condensing metallic fumes consists in placing in the flue, into which the furnaces open, a number of steam jets, and in building a tower near to the chimney, which is separated into two compartments by a division reaching nearly to the top of it. The fumes flow up one compartment, but are intercepted in their passage down the other to the chimney by a layer of burnt coal, or broken pieces of brick, while a shower of water continues to flow in at top. When the draught of the chimney is not sufficient to draw through the layer of coke, it is increased by means of steam jets placed in it.

Claims.—1. The purifying of tea lead by the application of hot air.

2. The use, in the manufacture of white lead, of nitric or acetic acid, or acetate of

lead, steam or hot air, and carbonic acid gas.

3. The arrangements for condensing metallic fumes, with or without extra steam jets.

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal.*]

FOR AN IMPROVEMENT IN STEERING VESSELS. *George W. and Ezra B. Robinson.*

The design and purpose of this invention is to turn the rudders of vessels by a new and more advantageous application of mechanical powers, and without the use of a tiller or tiller ropes.

For this purpose the rudder head should rise above the deck, nearly as high as the axis of a vertical steering wheel of a convenient diameter and position, which will probably be from 12 to fifteen inches higher than the rudder head is usually made. On the top of this rudder head, which may be made polygonal for the purpose, is fixed a strong metallic horizontal cog-wheel, of about twenty inches in diameter; playing into the teeth of this wheel, on each side of it, is a horizontal metal rack moving fore and aft in parallel guides; these racks are to be of such a length and with such a number of teeth as to turn the cog-wheel as far each way as the rudder ever needs to turn. This will require the whole length of the racks to be about two feet seven inches, and the teethed part eighteen inches. The guides are in the sides of an oblong frame, long enough to permit the play of the racks and a little higher than the top of the rudder head. The forward end of one of the racks, and the after end of the other, is prolonged solid and without teeth, and bent upwards and turned inwards to the middle of the frame, so as to rise so far above the line of the top of the rudder head, that the bottom of the shaft hereafter described shall be two inches above the rudder head, so as to allow the rudder the necessary play up and down. These prolongations of the racks end in hollow nuts above five inches long, with spiral threads cut in contrary directions, that is, with right hand threads in one nut, and left hand threads in the other. These two nuts are in a line with each other, which line passes over the centre of the rudder head, and having bearings on the two ends of the frame, is a horizontal iron shaft, about six feet long and two and three-quarter inches in diameter, the forward end of which is fixed to the centre of the steering wheel at its axis. Where this shaft passes through the nuts it is formed into two spiral screws, each about twenty inches long, having two or three threads of such obliquity as to give about two-and-a-half inches at each turn of the wheel, to enable the rudder to give sufficiently to the force of the seas. One of the screws is a right hand screw, and the other a left hand screw corresponding to the nuts above described. On the after end of the shaft, and outside of the frame, is placed a vertical steering wheel, of the usual size and form. As the steering wheel is turned, the spiral screws on the shaft move one rack forward and the other back, turning the cog-wheel and the rudder to the right or left, as required. Instead of having the frame supported at the after end, it may be bolted into the stern frame of the vessel, and properly braced, by which it may be made to occupy less room on the deck.

Claim.—The machine or combination, consisting of the cog-wheel on the rudder head, the sliding racks, with the hollow nuts and screws, the shaft, with the right and left hand screws, and the steering wheel.

"*Blunt, Oh!*"—A Company is advertised as in the course of formation to be called the "Dublin and Holyhead Submarine Telegraph," with a capital of £40,000. The prospectus is headed "By Authority of Her Majesty's Government;" and the proof given of this "authority" is, that "the Right Hon. the Lords Commissioners of Her Majesty's Treasury, and the Right Hon. the Lords Commissioners of the Board of Admiralty, having granted to Mr. Charles John Blunt, C.E., *their authority and privilege* to lay down this line of submarine telegraph *the company is formed under such special authority* to carry out the undertaking." To prevent any person being taken in by this very audacious announcement, we think it right to state, that neither the Treasury nor the Admiralty have the power to grant Charles John Blunt, C.E., or any one else, "such authority and privilege" as they are here alleged to have done, and that it cannot be true that they have done anything of the sort. This much they may possibly have said—for it accords with their ordinary practice in such cases—that they do not see how any harm is likely to result either to the revenue or the navigation of the country (branches of the public service under their immediate charge) from laying down a line of wires at the bottom of the Irish Sea, and will offer, therefore, no opposition on their parts to Mr. Blunt and his project. But so they would have said, had his proposition been to lay down a line from Holyhead to Hong Kong, and so they would say to-morrow to any other person who might apply to them on the subject. Mr. Blunt's "privilege" and "special authority" are just the same as any other man's "privilege" and "special authority" to practise on the credulity of the public.

Elastic Moulds.—At the School of Designs, Sheffield, Mr. Young Mitchell, the master, gave a lecture, illustrated by experiments, on the art of making elastic moulds. It has great advantages over the old plan. The moulds may be made at small cost, and with great rapidity. That which would occupy five or six days in the modelling may be furnished by this process in half that number of hours. By the facility thus afforded beautiful forms may be multiplied so cheaply as to be brought within the reach of all. The principal material used for the elastic moulds is glue or gelatine. The best fish glue will answer as well as gelatine, and is much cheaper. The material is dissolved, like glue, in a vessel placed over the fire in a pot of hot water, stirring it during the process. To each pound of the gelatine it is necessary to add three-quarters of a pint of water and half an ounce of bees' wax. It is ready for use when about the thickness of syrup.

The model must be oiled carefully with sweet oil,—and the composition must be poured upon it while warm, but not boiling. Having set, it may be taken off the model. When the model is small it should be placed in a shoe or case, which gives facility for shaking the mould well when the plaster is poured, so as to drive it well into the crevices. The plaster should be fine; and in order that it may harden and set quickly, about half an ounce of alum should be added to each pint of water used in mixing it. Before using the mould it should be carefully oiled. Great care is required in mixing the plaster, and watching it when in the mould, for if it be allowed to remain long enough to heat, the mould is destroyed. Mr. Mitchell exhibited moulds, and casts were taken from them in the presence of the audience.—Mr. Mitchell also exhibited a specimen of stearine, and explained how casts may be made with a shining and wax-like appearance.—*Sheffield and Rotherham Independent.*

WEEKLY LIST OF NEW ENGLISH PATENTS.

Charles Thomas Pearce, of Park-road, Regent's-park, Esq., for improvements in apparatus for obtaining light by electric agency. February 16; six months.

Charles Frederick Whitworth, of Hull, gent., for improvements in preventing accidents on railways. February 17; six months.

John Bottomley, of Bradford, York, Manufacturer, for improvements in machinery for weaving. February 22; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subject of Design.
Feb. 15	1782	Deane, Dray & Deane,	London Bridge	Cinder-sifter.
16	1783	George Allen	Stepney	Safety catch for the handles of railway and other carriage doors.
19	1784	Edward Newman Fourdrinier	Camden Town	Hat suspender.
20	1785	William Burgess	Blackfriars'-road	Gutta percha label-holder.
,,	1786	Welch, Margetson, and Co.	Cheapside	Aerial stock.
22	1787	M. M. Gariel	Paris, M.D.	The aqueductor for surgical purposes.

NOTICES TO CORRESPONDENTS.

Mr. Medworth in our next.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co. Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1334.] SATURDAY, MARCH 3, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

FONTAINEMOREAU'S CONTINUOUS VENEER-CUTTING MACHINERY.

Fig. 1.

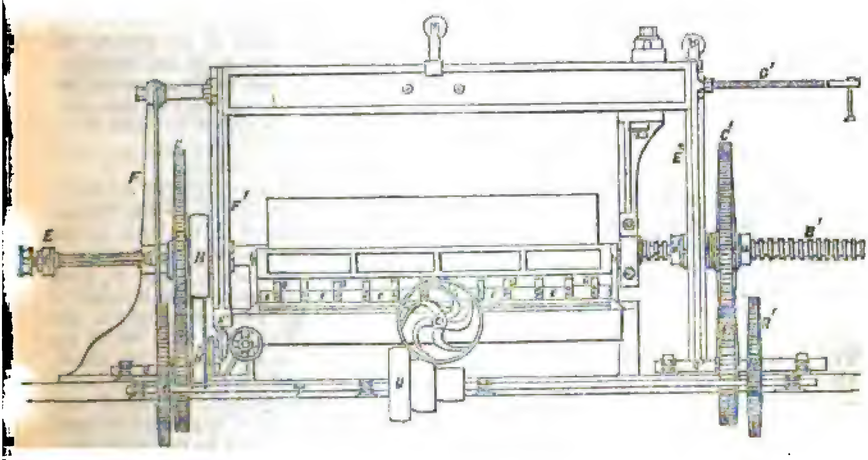
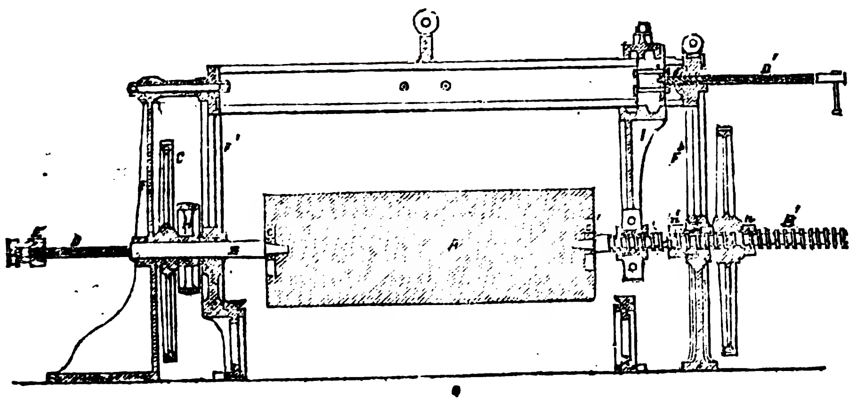


Fig. 2.



MR. FONTAINEMOREAU'S CONTINUOUS VENEER-CUTTING MACHINERY.

(Patent dated May 25, 1847. A Communication from Abroad.)

Machines for cutting continuous veneers are not new. Holtzapffel speaks of the mode having been introduced from Russia of "cutting veneers spirally from a cylindrical block of wood, with a knife of equal length—as if the veneer were unrolled like a piece of silk, or cloth, from a roller—and states that it "has been latterly applied to the preparation of ivory into similar veneers."—(*Turning and Mechanical Manipulation*, vol. i., p. 154, 1843.) To this passage in the text there is subjoined the following foot note, "Monsieur H. Pape, of Paris, piano-forte manufacturer, has taken out patents for this method of cutting ivory spirally into sheets. A specimen 17 inches by 38 inches, and about one-thirteenth of an inch thick, glued upon a board, may be seen at the Polytechnic Institution, Regent-street, and M. Pape advertises to supply sheets as large as 30 inches by 150. He has veneered a piano entirely with ivory." The inventor of the machinery, now about to be described, alleges, however, —the advertisements of M. Pape notwithstanding — that "the mechanical means employed ('to cut wood into thin and continuous sheets of any desired width') have proved insufficient to produce practical results, and (that) manufacturers have not been able to operate *but on small widths*." He claims for his machinery the merit of being the first to "cut wood of *large widths* in a continuous manner" and with "economy of time and labour."—"A log of mahogany, for instance, whatever be its size, set in my apparatus, is cut in a continuous manner—(so as to form a spiral developed from the circumference to the centre) — without any interruption and with a velocity truly surprising." His description of the "apparatus" has not been rendered into the best possible English, and is in some parts, therefore, rather unintelligible; but we prefer giving it as it stands in the specification, to venturing on any emendations of our own. The illustrative figures are at all events plain enough, and may help to clear up what is obscure in the text.

My means, which as it will be easily seen are entirely new, comprise:—

Firstly. The application of a sharp-edged and very thin blade, held fast between two knives or straight rulers ending in basil, which, while they keep tight the blade over all its length and near its cutting edge, prevent it on one side from going too deep into the wood, and on the other side force it to penetrate far enough into it, and to the required degree, according to the thickness designed for the sheets. That application, or rather addition of a thin blade working between two knives, is of the greatest importance for the success of the operation, and forms, I venture to say, a mechanical principle quite new, not only in the apparatus hereinafter described, but also in all other machines for wood-cutting, either from prisms, blocks, or logs.

Secondly. The disposition of a strong leader set immediately above the knives, and resting constantly on the wood as fast as it is cut. That pressing leader, which is of a quite new application, is also of great importance in the operation, as it serves to keep the wood fast over all its length, and close to the part which is to be cut by the blade; so that, notwithstanding the knots, brambles, and defects which the knife meets with, it is always perfectly supported, and cannot be the cause of any defect or accident. If even the wood by its nature were very defective, uneven, and presented very little homogenousness in its different parts, it would nevertheless be well cut, and with all the precision and nicety that could be wished for.

Thirdly. The mechanism adapted for working the blade or knife-bearer, and at the same time the pressing leader in a continuous manner, is always proportioned to the relative velocity given to the piece of wood to be cut. That operation is very essential, and was not obtained by the previous machines. I am enabled by it to produce sheets of a surface constantly even, and of an equal thickness upon all their width, from the beginning to the end of the spiral.

That mechanism is the more valuable as it can be varied at will, in order to modify the thickness of the sheets, as in all case the progress of the blade and of the leader is proportioned to the motion of the block: that is to say, the quicker the block turns the more the progression of the blade and leader is rapid, and so reciprocally, whatever be the thickness previously regulated.

Fourthly. The addition to the machine of a moveable drum, or cross-bar, provided

with several arms, permitting to receive simultaneously a certain number of pieces of wood, and to cut them into thin and rectangular sheets, instead of continuous sheets, which in many cases enables me to make valuable applications of my invention to bramble woods and others.

Without the particular means which I have hereinbefore mentioned, and which constitute the whole of my invention, that is to say, all the principal or working parts of the machine, it is quite impossible to obtain the practical results which I produce, especially when it is required to operate on pieces of wood of large dimensions, as, for instance, upon logs of two or three yards, or even more in width, and upon any diameter and size whatever.

Fig. 4.

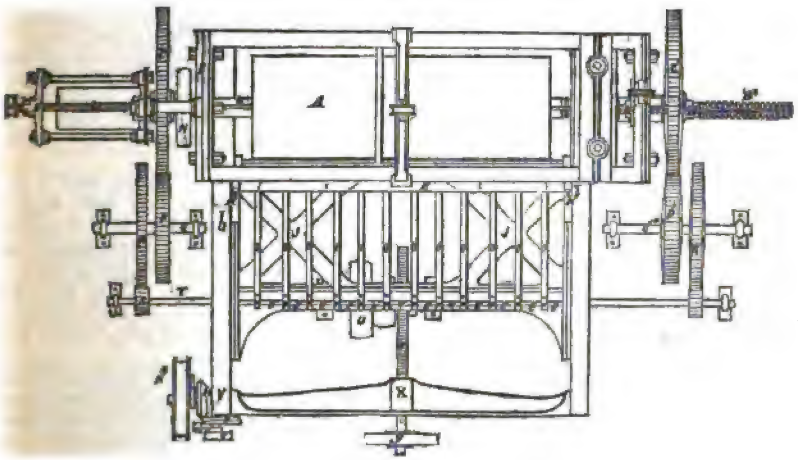


Fig. 3.

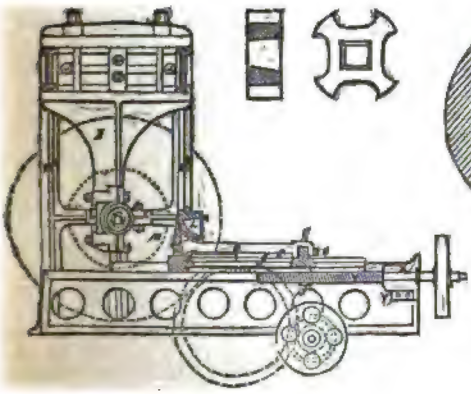


Fig. 5.

Fig. 7.

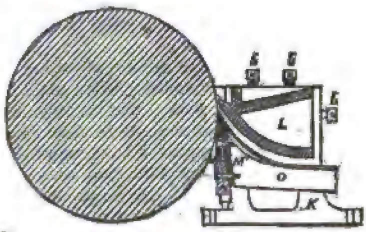
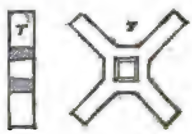


Fig. 6.



In order to have the system of my machine perfectly understood, it is indispensable to comprehend its full description hereinafter given. It will be easy, not only to admit the mechanical principles of the apparatus, and the dispositions which I have herein before-mentioned, but also the different particulars and the principal parts of its construction. It will be seen, as I before said, that it can be applied at will to cutting wood from a single piece into continuous and very large sheets, as to cut wood from several narrow pieces into rectangular sheets, proportioned to the sizes of the same pieces.

Description of the Figures.

Fig. 1, shows a longitudinal elevation of the machine entirely set up, and ready to cut up a large piece of wood.

Fig. 2, is a longitudinal section taken through the axis, according to the lines 1, 2, of the plan.

Fig. 3, is a transverse section taken perpendicularly to the preceding, according to the line 3, 4. And

Fig. 4, is a general plan of the machine, as seen from above.

By examining the several views and details of the apparatus, it will be seen, that the log or piece of wood, A, to be cut, is not set on mere conical points, as on a lathe, but on two square points of the iron axis, BB^1, between which it is held sufficiently fast to avoid its having any play, but so that it may fall in steadily with the simultaneous rotary motion of these two axes. At its ends are adjusted the iron cross-bars, C, which serve to maintain it on their points in a steady manner, and to keep it always perfectly in the centre from the beginning to the end of the operation. The forms of these cross-bars are similar to those shown by figs. 5 and 6; the largest of these are applied to the largest logs of wood, and the smallest replace the former when the logs are reduced to a small diameter. These cross-bars being at their centre pierced with square holes, having the exact form of the points, it is easily understood, that when these points are inserted in the holes, the piece of wood is connected with the axis B, and B^1, in a continuous and solid manner, and must necessarily turn with them when they are put in motion.

As the logs of wood are not always of the same length, it is absolutely necessary to be able to cause the points, and consequently the axes, to advance and recede when requisite. For that purpose I have adapted to the end of one of these axes, that marked B, a screw, D, fig. 4, and fig. 2, which can be turned by the hand, without giving to the axis the same rotary motion. That screw, D, passing through a permanent nut, E, is obliged to move when turning, and, consequently, causes the axis to advance or recede; and as that axis is held by two strong supporters, FF^1, between which are placed the cog-wheel, G, and the pulley, H, set on the said axis, those two pieces, G and H, cannot move with it, as they are kept between two supports. Thus the screw, D, and its axis, B, only move and change their position.

The second axis, B^1, is by itself a screw; it is wormed over all its length, and is provided, as the first axis B, with a cog-wheel, G^1, having exactly the same diameter as the first-mentioned wheel, G, and which also must rest in the same place, whatever may be the position given to the axis. For that purpose this wheel, G, is kept on one side by the large supporter, F'', by means of a nut, *a*, which presses against it, and on the other side by a nut, *a*, which rests on the nave of the said wheel, G^1. When that axis, B, is to be made to advance or recede, those nuts are loosened, and then, by means of the screw, D, placed above, the moveable bearer, I, is made to proceed. That bearer, I, serves, at its lower extremities, as a supporter to the wormed axis, B^1.

That second screw, D^1, produces exactly the same effect as the former one, D; its nut, E, being also permanent, is obliged to move according to its length, when it is made to turn lengthwise on the right or left side.

When the position of the two axes, BB^1, has been so regulated, that their square points are inserted, and kept into the cross bars which are adjusted to the extremities of the log of wood, as shown by figs. 2 and 4; the position of the blade-bearer carriage must be adjusted so that the more forward knife should advance, and rest on the external surface of the log.

That blade-bearer carriage is composed of a cast-iron frame, J, which, at its two opposite extremities, is provided with the two cast-iron chairs, R, intended to receive on one side the cast-iron guide, or pressing leader, L. That last guide rests constantly on all the length of the wood, immediately above the sharp edge of the blades, in order to prevent them from causing the wood to split, or from taking off a greater quantity of it than they ought really to do. The application of that leader, L, to the machine is, as has been herein-before described, of the utmost importance, as it permits to obtain results which could not possibly be attained without its use. It has been disposed in such manner that its position may be regulated as exactly as it can be required. For that purpose the cast-iron chairs, K, which are to support the extremities of the above-mentioned leader, are crossed by bolt screws, *b*, which allow it to be lowered, raised, or moved on the right or left side, to be inclined in one way or another, so as to comply with all the required necessities, according to the nature of the wood, the thickness of the sheets which are to be cut, &c. In order to make well understood the construction of that guide or leader, it is represented minutely in fig. 7, which is a transverse section. From this it is easy to understand, that, by its nerves and its strong thickness, it presents a great resistance. As it must bear

with a certain strength during the working on all the length of the log, it is expedient to make it solid and without chance of being flexible.

The two knives, MM¹, between which is kept tight the additional blade, *l*, by which the wood is cut, are placed underneath the forward face of the guide, L, and in a tangential direction to the external circumference of the log, as shown by fig. 7. Those knives are both fixed by a cast-iron ruler, N, going over all their length, and are kept in an immovable position by means of the iron holdfasts, O, on the extremities of which they are screwed. Their fastenings are placed at equal distance, and in a sufficient quantity, over the breadth of blade-bearer carriage. In order that the latter may give to the knives the exact position which is necessary relatively to the pieces to be cut, it has been necessary to adjust on one side upon the ends of the chairs, K, some projecting screws, *d*, upon the heads of which the ruler, N, rests at its extremities, so as to cause it to occupy a more or less elevated position; and on the other side some bolt-screws, *e*, have been placed on the forks which end the iron holdfast, O; the screw, *e*, holds the holdfasts, O, upon the blade-bearer carriage, and permits at the same time, to incline them more or less, or cause them to advance or recede relatively to the surface of the log. It results from that contrivance that, whatever may be the size of the block, the direction of the knives and of the blade can always be regulated so as to have the sharp edge of this last in the most convenient part; that is to say, in order that on one side it should not tend too much to penetrate into the wood, for which purpose the forward knife, M, resting on the surface of the cylinder, guides and maintains that blade, and in order that the other side it should not hold back. That is prevented by the blade held by the second knife, M¹, which rises very near the sharp edges, and forces in the mean time the sheet, as soon as it is cut, to pass between it and the pressing leader.

It is therefore evident by that contrivance, that the cutting-blade is neither too eager nor too slow in working.

When the machine has been regulated for a required thickness, it is certain always to be obtained all through the operation.

That disposition is the more remarkable, and the more advantageous, as it permits to change the blade and the knives, to put them on or take them off with greater facility, without disconnecting the other logs which may be fastened to them, as it suffices to loosen the screws which fasten them to the iron holders.

When the blade and the knives which hold it fast, as well as the pressing leaders, are exactly regulated, the machine can then be put in motion. To that effect it is to be observed, the movements have been so disposed that the two axes, BB¹, at the extremity of which the log is supported, may both at the same time be acted upon with the same velocity, in order to prevent any attempt to twisting, and to have the block moving regularly all along its length. Thus it has already been seen, that the two similar wheels, GG¹, are set upon those axes to which they are fastened, each of them by a pin, adjusted in a groove contained in their length, in order to allow them to remain in the same place. When the axes are caused to advance or recede, those wheels catch with the pinions, P and P¹. Figs. 1 and 4, which are set on the intermediate shafts, Q and Q¹, which are themselves commanded by the eight wheels, R, R¹, adjoining the preceding, and catching with the pinions, *s.s*. These two last pinions, of small diameter, are set on the same shaft, T, which is the moving shaft of the machine, and which, for that purpose, is provided with the pulley, U, having several diameters, in order to receive, in case of need, different speeds, more or less rapid, according to the dimensions or size of the logs to be cut.

It will be easily understood, that the motion can be given to those pulleys by any moving power whatever, by means of which a convenient velocity may be obtained.

Whilst the rotative motion is so given by means of those transmissions of movement to the piece of wood set between the two points, the blade-bearer carriage is caused to advance very slowly, and of a quantity corresponding to the thickness of the sheets to be obtained.

That forward motion is effected by the machine itself, without any trouble, and in the following manner:

Under the carriage is set a nut, *f*, through which passes an horizontal screw, V, inserted in a collar contrived in the centre of the cast-iron cross-bar, X, bolted on the sides of the main frame, Y, which serves as a basis to the carriage. On the head of that screw is set a pulley, *g*, facing another smaller pulley, g^1, set in a small intermediate axis represented in fig. 4, and provided with a small bevel wheel, *h*. This last wheel receives its motion from a similar wheel, h^1, fastened to a second axis similar to the first, but perpendicular to the precedent, and bearing a pulley, H¹, which has been already represented as placed on the axis, B. Thus the movement of the screw, V, having a very small worm, is always proportional to the velocity of the rotative motion of the

log of wood. The more quickly the block turns, the more rapidly also the blade-bearer carriage advances. But if the thickness of the sheets is to be changed, it is necessary to modify the ratio of velocity, which is effected very easily, as it suffices to replace one of the pulleys, *g* or *g′*, by another larger or smaller one. By this contrivance, sheets extremely thin, or of any required thickness, can be cut all over the length of the log of wood.

It is understood that, as the log turns in a continuous manner, and as the blade-bearer carriage is always advancing progressively at the same time, and of a similar quantity; the sharp edge is always made to rest tangently on the external surface of the log. By such means it is perfectly easy to cut sheets of a perfectly equal thickness, the development of which can reach several hundred yards without interruption.

This mechanism, by which the knife-leader and the blade-bearer receive a motion in a continuous manner, and proportioned to the rotative movement of the block, is therefore equally very essential.

From the apparatus before described, not only very long slices or sheets can be cut from a log, but also from any piece of wood, whatever may be its shape, the dimensions of the sheets being, however, proportioned to the sizes of the pieces of wood. To obtain that effect, it is sufficient to set, in lieu of the two axes, B and B[1], which support the blocks, a drum, which is composed of an iron shaft and of several cast iron discs or cross bars, on the plain parts of which are bolted two set-up flat bands, intended to receive some wooden frames. The pieces or blocks of wood to be cut, are fastened upon those frames in the same manner as they are set upon the ordinary frame of the sawing machines for veneering. It is easily understood that, by causing that drum to turn on itself, as it would be done in causing the block which it replaces to turn, each of those pieces of wood is successively presented to the action of the blade end of the knives, and will be cut into thin sheets, which, as a matter of course, will be separated from each other.

That disposition is also a most important addition to the improved apparatus, and increases as much the value of that system which thus unites all the required advantages for practical and manufacturing working; and by the celerity with which the operations are carried into effect, by the great saving of wood which it effects, as well as on account of all the profit obtained from the machine and the excellent work it produces, that system affords very great advantages. Another very simple addition is equally applied to that machine, and has for effect to cut the wood, not only in sheets, but also immediately after into matches of different lengths and sizes. That addition consists merely in the application of a cylinder set on the leader itself and provided with circular blades. These blades rest on the wood and cut it transversally, that is to say, perpendicularly to its own axis, whilst some grooves contrived over all the surface of the cylinder impress on the wood, a kind of denting, more or less deep, while at the moment that the lower cutting-blade arrives to perform its operation, causes the sheets of wood already cut in the direction of the axis to be separated in small breadths, and at the same time as the saws divide the wood lengthwise.

This additional cylinder is composed of an iron axis, in which is adjusted a set of blades or circular knives, supported at the required distance, according to the length of the matches by means of steel rings or washers, which are fluted on all their circumference, that they may at the same time serve as trowels. This axis is supported at its two extremities on two moveable bearers, properly set upon the upper part of the leader; they are able to approach more or less according to circumstances; the log of wood to be cut either by means of screws purposely adapted or by any other suitable contrivance; consequently, if that cylinder, prepared as before described, be sufficiently advanced against the wood, so as to cause the circular blades to penetrate into it to a certain depth at the same time that the rowels, or washers, *y*, bear firmly upon it, so as to impress deeply their projecting spokes, and the surface of the wood being afterwards cut in the manner before described, by means of the lower longitudinal blade, the matches may be entirely separated one from the other, or allowed to remain slightly adherent, which would facilitate their packing up and carriage.

The patentee describes also an apparatus for parting and laying thin sheets of wood together, but this we must reserve for a future Number.

SMITH'S YIELDING SEA BARRIERS.

Sir,—I confess it is not without some regret that I find myself unable to follow your able correspondent, Mr. Dredge, through the reasonings of his second paragraph, p. 151, (*ante*). I can clearly understand that a weight of 100 lbs. having fallen through a height of 10 feet has then accumulated in it 1000 dyna-

mic units, and is equivalent to a weight of 1000 lbs. falling through 1 foot, 2000 lbs. falling through 6 inches, and so forth. The process of abstraction of the space, with a corresponding increase of the moving weight, evidently terminates in the representation of a dynamical force by the statical pressure of a quiescent body — an effect partially explained in an article of mine, p. 59, of your current volume.

But I am unable to understand how it follows that if this weight of 100 lbs. had, at the end of 10 feet, chanced to fall "upon a spring and compressed it through a space of 1 foot, it would register a maximum pressure of 2000 lbs.;"—or "if the weight fell upon a large stone, or upon an iron anvil, and compressed the surface of the material through the $\frac{1}{100}$th part of an inch," it appears incomprehensible how these circumstances could magnify the "blow at the instant of greatest compression to 240,000 lbs."

I have not had the advantage of seeing the inventor's description of the "Yielding Sea Barrier;" but taking Mr. Dredge's diagrams as representing the *modus operandi* of the contrivance, some interesting points suggest themselves which do not appear to have been noticed. In fig. 1 of the accompanying diagrams, let $AD=c$, $PC=r$, $DH=x$, $HP=y$, $\angle DCP=a$.—The path of the joint P, from D to E being a circle, $\therefore y^2=2rx-x^2$: again $(c+x)^2+y^2=AP$ and eliminating y, we have $C^2+2(cr+r^2).(1-\cos a)=AP^2$. Hence,

$$\text{Cos } a=\frac{AP^2-C^2}{2(cr+r^2)}-1 \ldots\ldots\ldots (1)$$

Draw AL perpendicular to B_1P, and put $AB_1=R$, $B_1P=l$, $\angle AB_1P=B$; then $AP^2=R^2+l^2-2Rl.\cos\beta$;

$$\therefore \cos B=\frac{R^2+l^2-AP^2}{2Rl} \ldots\ldots (2).$$

Now as the point P moves from D to E, the line AP continually *increases*, and by inspection of the foregoing equations, we perceive that the angles a and B also increase as AP. From the equation (1) when P coincides with D, $AP=c$, and $\cos a=r$, and when this occurs it appears from *eq.* (2) that the

$$\cos.\ B=\frac{R^2+l^2}{2\,Rl}-C^2=\cos.\ ABD.$$

Hence the increments of increase which these angles receive as the pile is pushed from the vertical towards its limiting position AB_2 are in the ratio of $(cr+r^2)$: Rl.—

Referring to Mr. Dredge's investigation, I apprehend there is an oversight in his assigning *two* points in the barrier, namely F and D, and also in omitting to take account of the buoyant force of the water upon the frame. That the various elemental forces exerted upon the pile by the sea, act in parallel directions, is a position which will not perhaps be disputed; but the point of application of their resultant is not so easily fixed with certainty. Suppose, however, that point to be found at B, fig. 2, and PB the resultant referred to; then a single force QB=PB, applied in the opposite direction, would hold the pile at rest, if no other force acted upon it It appears, therefore, to me that this is the point at which the tension bar, BW, ought to be attached, and it may be shown that a higher or a lower point would produce repercussion upon the joint A, and be so much resistance not only uselessly, but mischievously expended.

Representing by W the weight of the counterbalance attached to the tension bars at W, and by θ the inclination of the pile at any time from the vertical, the tension in

$$BW=W.\frac{\cos\theta}{\cos\beta};$$

and the moment of the force round the point A is

$$W.\frac{\cos\theta}{\cos\beta}.AL=W.\frac{\cos\theta}{\cos\beta}.R.\sin\beta=$$
$$W.R.\cos\theta.\tan\beta\ldots\ldots(3).$$

Putting n for the number of solid units in the portion of the pile immersed, and μ for the weight of an equal unit of water, $n.\mu$=the weight of the volume of water displaced by the pile; and its moment round its centre of gravity, E, is $n.\mu.\delta.\sin\theta$, in which $\delta=AE$. Adding this element to expression (3), the sum of the moments which tend to turn AB round the point A in the direction QB, is

$$W.R.\cos\theta.\tan\beta+n.\mu.\delta.\sin\theta\ \ldots\ldots(4).$$

Now, the moment of the resultant, PB, in an opposite direction is P.R, in which P is taken to represent the amount of that resultant; and by the principle of the equality of moments we have for the conditions of equilibrium,

$$P.R = W.R.\cos\theta.\tan\beta + n.\mu.\delta.\sin\theta;$$

$$\therefore P = \frac{W.R.\ \cos\theta.\ \tan\delta + n.\mu.\delta.\ \sin\theta}{R} \quad \ldots\ldots\ldots (5).$$

Fig. 1.

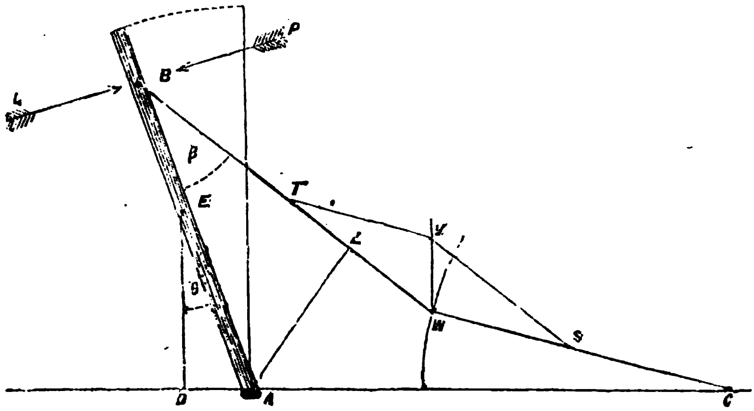
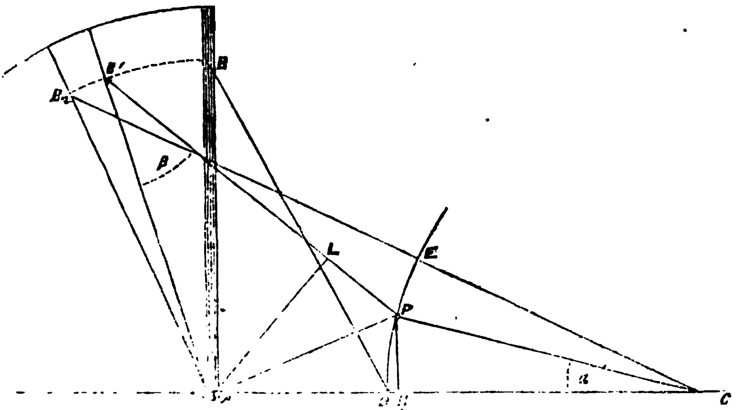


Fig. 2.



It is obvious that were a gangway constructed on top of the piles, or any portion of the material of the barrier projecting above the water surface, a moment of force would, in consequence, be *added* to the impulse of the sea, and therefore so much taken away from the effective resistances of the moorings. The gangway, indeed, seems to be an attempt to combine with the barrier a degree of accommodation incompatible with the circumstances of the case.

Referring to expression (3), we find that the moment of resistance offered by the moorings is W. R. cos θ. tan. β, in which, if we suppose W, R, and θ to become fixed or constant, the moment will vary as tan. β. Now as the point C recedes from A (other things remaining the same), the angle β increases, and therefore the moment of resistance—a circumstance which suggests the idea that advantage may be gained by placing the point, C, as remote as practicable

from A. The distance, AC, length, AB, and $\angle \theta$ being assumed, the sum of the lengths of the bars, the relative position of the joint, W, and the point, D (fig. 1), on the horizontal line are necessarily dependent upon the assumed data. Should time permit, I may return to this point of the subject on another occasion.

Mr. Dredge, in his investigation, has shown that the amount of tension in each bar is truly represented by the sides of the parallelogram, TS, the side, WT, measuring the tension in BW, while WS or TV measures that in WC. I have, therefore, only to observe upon this point, that as the force, P, requisite to bring the bars, BWC, into a straight line, is infinite, it follows that the pile can never reach the position indicated by AB_2 (fig. 1); and that the limits of elasticity or yielding in the barrier cannot therefore be reached by any assignable force acting at the point, B, while the material of the tension bars and their fixtures are of sufficient strength to offer the necessary resistance. I am, Sir, yours, &c.,

T. Smith.*

Bridgetown, Wexford,
Feb. 22, 1849.

SYLVA SYLVARUM NOVA.†—NO. III.

Sir,—It would be well if the long interval which has elapsed since my former communications under the same title, could be excused by pleading the necessity of mature consideration of the subject I am discussing. It may be remembered that I proposed to describe the main outlines of a book which I am convinced would be eagerly and profitably consulted by many an active, ingenious discoverer. Such a work might worthily engage the energies of the cleverest man in England, and not every one ambitious of the task could expect to perform it even tolerably. The book would contain matter which would be naturally arranged round the three grand objects to be kept in view:—

I. An accurate survey and mapping out of the boundaries of knowledge in each particular science.

* To prevent the value of this paper from being affected by any misconception as to the authorship, we think it right to state that Mr. T. Smith, of Wexford, and Mr. W. H. Smith, the inventor of the sea barrier, are not only two different persons, but in nowise related to one another.—Ed. M. M.

† The two former communications under this head may be found at pp. 413 and 494 of vol. xlviii.

II. A collection of the opinions of eminent men as to the desiderata most to be toiled for, and with the best prospect of success and reward—positions each of which, when attained, might become a *point d'appui* for the basis of further exertions.

III. General hints to explorers, derived from the experience of those who have long ago or lately travelled the paths of philosophy, and have enriched us with new truths.

I compare here the expanse of knowledge to a country—its numerous departments to separate yet contiguous districts—its confines, when marked by features which are at once resting places and obstacles, to the rivers, mountains, or deserts of a continent—its new prospects, seen dimly, to the unknown regions, which invite the traveller in search of novelty or of gain; and this simile is too striking to be laid aside without our being made sensible that to write on such subjects as the present, without using metaphor, is extremely difficult.

The word *known* in the first of the three divisions, is a term, of course, purely relative, and may mean investigated, considered, reached, probed, examined, discovered, but can never mean exhausted, and, strictly speaking, no one point on which the mind can rest for a moment, has its ultimate relations to other points completely unravelled, or its own characteristic qualities so trite as not to repay inquiry.

Yet we may speak popularly with respect to arts, sciences, and manufactures, and call such mechanical or chemical facts known as can be seen to be chained by the law of cause and effect, whilst we term *unknown* whatsoever appears isolated, or has not invited, or has baffled close scrutiny.

Thus it is known that unannealed glass may be shattered into atoms by a very slight vibration—that an effect called electricity may be propagated along a metal wire with immense velocity—that the speed of a ship is remarkably dependent on its form—that the richness of a crop of wheat is influenced by the quantity of stones lying on the earth it has grown from.

Yet, in the first instance, the phenomenon is singularly isolated from others, and its connection with others is a desideratum in the opinion of a philosopher.

How electricity is propagated in the second case, is unknown; but its connection with other facts no less themselves *unknown* (in one sense), is a desideratum to the physician, the analyst, and the lover of rapid news.

Again; the form of a ship's hull—the disposition of its weight and canvass—exercise an unascertained influence on its speed. Yet every successful improvement on Scott Russell's lines, or any others, is a desideratum to the whole commercial world. And if the circumstances of superincumbent stones alter the price of bread, some knowledge of their connection with other data is a desideratum to the community at large. Humboldt has woven this task into the more general design of the first volume of "Cosmos," and we see more detailed catalogues of our landmarks in works such as the "Year Book of Facts," &c., and many things excluded from such books, because not yet sufficiently *interesting*, may be heard in lectures and read in scientific periodicals. And yet, after all, these great facts are not so numerous in any one science as to dishearten him who essays the truthful survey of every one of them. "There are not," says Dr. Kitchener, "*so many certain truths* in this world as some children imagine."

Turning to the second division, let us listen to the condensed wisdom of the immortal Baron of Verulam. He enumerates the obstacles which hinder the advancement of learning, and proceeds,* "The last defect which I will note, is, that there hath not been, or very rarely been, any public designation of writers or inquirers concerning such parts of knowledge as may appear not to have been already sufficiently laboured or undertaken; unto which point it is an inducement to enter into a view and examination what parts of learning have been prosecuted and what omitted; for the opinion of plenty is among the causes of want, and the great quantity of books maketh a show rather of superfluity than lack, which surcharge, nevertheless, is not to be remedied by making no more books, but by making more *good* books, which, as the serpent of Moses, might devour the serpents of the enchanters!" And, further on†—"And like as the West Indies had never been discovered if the use of the mariner's needle had not been first discovered, though the one be vast regions and the other a small motion—so it cannot be found strange, if science be no farther discovered, if the art itself of invention and discovery hath been passed over." This last sentence convinces me that Bacon perceived the necessity of a work such as I am considering; but nothing less than the whole range of philosophy seemed to demand his attention. He died before he had completed (or could have hoped so to do) that part of the labour which I have discussed first, and so his "Sylva Sylvarum" contains but little of that mass of pregnant suggestion which might have been expected had such an author been engaged on the second portion of the work.

In his age, a man attempted a cyclopædia. Our "Sylva Nova" might be committed to many separate minds—nay, let a single science be explored for a beginning, and the desiderata announced as belonging to it be those vulgar ones only which enrich the common purse, and require no refined perception to appreciate them.

The utility of this section of the work would be proportioned to the comprehensive minuteness with which each topic might be handled. But here again I would rely upon that systematic apportionment which renders tasks easy by division of labour, which were before impossible.

Babbage, in his "Economy of Manufactures" laments how slow we are in applying this principle to mental operations, and yet, when tried, it has always been with success.* By means then of suitable allotments of parts, this portion of the subject might be treated minutely, and if not minutely, it must be without benefit. For we do not require to be reminded of the grand general problems now or heretofore inviting solution. These great questions often need great

* Vol. I., p. 73, Montague's edition of Bacon's works.

† P. 130.

* Adam Smith first insisted on this mental distribution successfully. An instance of a middle nature is cited, where by means of the division of mental processes as well as manual labour, the gigantic task of preparing the financial tables for the French government was performed by M. de Prony and his corps. His estimate of the difficulty may be gathered from this, "Il fut aisé à M. de Prony de s'assurer que même en s'associant trois ou quatre habiles co-opérateurs, la plus grande durée présumable de sa vie, ne lui suffirai pas pour remplir ses engagements."

minds to answer them, nor will the intellect which has not discerned their existence be likely to unravel them when pointed out. The wished-for truth may loom in the distance like a huge mountain, but the little hills which are near look higher, and only because they are near—and if Faraday or Humboldt can keep the distant peak in sight, and will direct us towards it in my first steps, we too may soon hope to discern it, and, mayhap, even to scale it.

I remember Faraday concluding a lecture with the observation, that one of the greatest and most desirable advances in philosophy which could be imagined in our times would be the acquisition of some power of making use of the enormous force which is latent now, and imbecile in combustion, and he alluded to one phase of combustion already thus partly governed, that of zinc and copper in the battery.

Here is an example, but on a large scale, of the treatment of an idea in the first and second divisions of our work. The *quasi* combustion of zinc and copper is applicable to useful purposes. The desideratum is a similar evolution of that force which is conceived or proved to be active in ordinary combustion. Yet this idea is beyond the capacity of any but a great mind, and the book I recommend is intended for ordinary ingenuity.

The discovery of the planet Neptune may be considered as another example of the system I desire to enforce.

The *known* of the sky was perfectly mapped in the German Observatory, and Adams reassured himself of the known as regards the theory and facts of Uranus.

He then discerned at once that the desideratum was an additional planet.*

These two steps advanced—one by those who executed the Berlin maps, the other by the Englishman, might still have allowed a third party to complete the discovery. But Adams took on himself the office, and we know with what a successful result. The first process was not complete in England, so far as regarded that part of the heavens to be observed, nor was the fourth stage—the mere eye work—entered upon with zeal by our astronomers, but the middle process—generally the least well performed—was here perfect. Would that we had an Adams in each department of philosophy!

In the division marked III., I do not mean by "general hints" that advice is to be given on manipulation, or that we are to be furnished with the processes of others from which ourselves to reason, like John Rey of old, or that each science is to be introduced by a work similar to "Berthollet's Chemical Statics," but rather that the mental workings of philosophers are to be set forth as well as the discoveries which have resulted.

Nothing, perhaps, is more intensely interesting to an inquiring mind than to be furnished with an accurate detailed account of all the ideas, experiments, failures, and gradual successes attending the birth of a great discovery. Take for example the development of the idea of a separate condenser by Watt,* or Davy's conception of his safety-lamp; yet how many wide and important steps are untracked, and how few chronicled except those which eventually turn out to have been in the right direction.†

Now, I am not advocating a book which is to confer wit on the stupid, or which is so to shackle *free genius* as to cramp its efforts.

A map does not convey the traveller across the desert it depicts, nor does it fetter his progress though it tells of dangers.

A compass cannot waft the sailor over the seas, nor will a barometer bring him storms. But adventurers in philosophy are forced to sail without chart or compass, and no wonder that many of them "claim" islands as their own which have already been *discovered* fifty times—no wonder that starting from the same point as their forefathers, they reach no farther all their life than they did. So that if the succession of syllogisms which, coursing through a fertile brain, result in discovery, is to be made available to posterity, it must be given complete.—

* This was discerned many years before, and such a conjecture would have figured in a "Sylva" written in that age.

* According to "Rees' Encyclopædia," article *Steam Engine*, Smeaton went close past this discovery of Watt's.—With what interest should we listen to the narration of the circumstances or train of thoughts attending this unfortunate divergence.

† Stuart in his "History of the Steam-engine" has done much to remedy this defect in the particular department of science which he illustrates.

Omit a step in the track, and all after this is useless, every successive pilgrim will wander at this point, and few will hit on the track resumed only a little further on. This made Locke account such disconnection one cause of ignorance, "When we have adequate ideas, and when there is a certain and discoverable connection between them, yet we are often ignorant for want of tracing those ideas which we have, or may have, and for want of finding out those intermediate ideas which may show us what habitude of agreement or disagreement they have one with another."

Can it be doubted that much of this ignorance would be removed if men were presented with well-chosen instances of the manner in which those "intermediate ideas" have been effectually interpolated by master minds?

But it is high time that should I conclude this paper and my remarks on this subject.

In doing so, I must observe, that its claims upon our deep consideration will multiply during our reflection upon it.

Let me commend its further treatment to those able to receive and willing to act upon the maxim of Sir Humphrey Davy: "Whoever wishes to enjoy *peace*, and is gifted with great talents, must labour for posterity. In doing this he enjoys all the pleasures of intellectual labour, and all the desire arising from protracted hope. He feels no envy nor jealousy, his mark is too far distant to be seen by short-sighted malevolence, and therefore it is never aimed at."

Yours truly,

JOHN MACGREGOR.

CLUTTON'S REGISTERED COLD DRAUGHT PREVENTER.

[Registered under the Act for the Protection of Articles of Utility. Samuel Clutton, of 79, Praed-street, Paddington, and 14, Oxford Mews, Cambridge-square, Builder, Proprietor.]

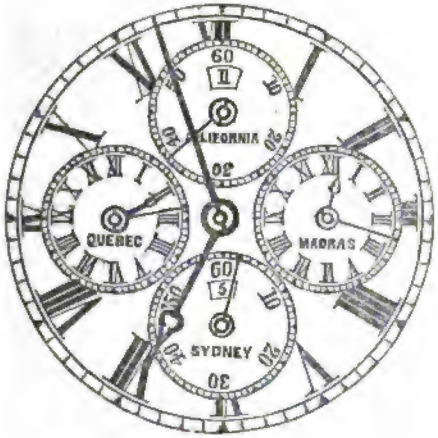
Fig. 1.

Fig. 2.

The best fitted doors shrink greatly after a time, and hence the necessity for sand-bags, screens, and other like contrivances to protect people from the draughts of cold air which are incessantly rushing underneath. Behold, at length, a complete remedy for this serious domestic grievance—a most ingenious addition which may be made to any door, old or new, and by which, shrink as it may, it will be always air-tight. Fig. 1 is a front elevation, and fig. 2 an end elevation of this invention as applied to a door. A is the bottom rail of the door; B, a thin plate of wood, permanently attached to the rail; C C are two bell-crank levers, which are sunk into recesses formed in the plate, B, and are connected at one of their free ends to a thin lath of wood, D, by links, E E; the other free ends have slots or notches formed in them; two small projecting pins, inserted into the side of a sliding rod, F, take into these notches, so that when the rod, F, is pushed forward from right to left, the lath, D, is made to move downward. The draught preventer is fixed to the door in the manner represented in fig. 2, with the bell-cranked levers, &c., next to the door. The end of the rod, F, projects a short distance. When the door is shut, the rod comes in contact with the door-post, and, through the intervention of the bell-cranks, presses the lath down upon the floor or carpet. G is a helical spring, which causes the lath to resume its position on opening the door. H H are guides, and I, a small vulcanized India-rubber tube, attached to the lower edge of the lath, D.

TANNER'S POLHORION CLOCK.

[Registered under the Act for the Protection of Articles of Utility. William Tanner, of 83, Upper-street, Islington, Inventor and Proprietor.]



The peculiarity of this " Polhorion " (*many hour*) clock consists in its exhibiting on the same dial-plate, but in distinct circles, not only Greenwich time, but the corresponding time at as many other places as there are circles. The whole of the different times are regulated by one movement and pendulum; and the clock can be made to show the hours either with or without an hour hand. The clock represented in the prefixed figure is set to exhibit the times at four different places — namely, Point St. Lucar, California, 109° 54′ W.L. 7ʰ 19′ slow; Quebec, 71° 5′ W. 4ʰ 44′ slow; Madras, 85° 22′ E. 5ʰ 21′ fast; and Sydney, 151·23 E. 10ʰ 5′ fast. In the circles 11 and 5, the times are indicated by an hour hand; in the others by the minute hand. When the minute hand arrives at 60 in each revolution, the hour immediately changes for the next in succession, as 10 for 9, 11 for 10, &c. The construction of the clock is stated to be "so simple that it is not liable to get out of order, and if forgotten to be wound up, by setting the centre number hand to its proper time, the whole are set to their respective times." No details of the interior machinery are given; and probably none are needed for persons familiar with this branch of mechanical art.

EXTRAORDINARY PHENOMENON.—PASSAGE OF HYDROGEN IN CURRENTS THROUGH SOLID BODIES.

M. Louyet has communicated to the French Academy of Sciences the following singular results of some experimental researches in which he has been engaged, into the properties of gases. If a current of hydrogen gas emanating from a capillary orifice be directed against a sheet of paper, held a few millimetres from the orifice, so that the current be perpendicular to it, the paper is traversed by the gas. But the gas does not percolate through, as might have been expected; it passes as a current, and may be inflamed behind the paper, as though nothing intervened between the gaseous current and the ignited matter; and farther, spongy platinum becomes incandescent behind the paper, in the path of the current, if the paper be three or four centimetres from the orifice, provided the metal is placed against the paper, or, at least, a very slight distance from it. The pressure under which the phenomenon is produced does not exceed from ten to twelve centimetres of water. "To my great surprise," M. Louyet adds, "I have established that hydrogen gas traverses with equal facility gold leaf and beaten silver. Thus, surround spongy platinum with several folds of gold or silver leaf, and direct against it a current of hydrogen, the platinum will become incandescent, and the gold or silver will adhere to its surface. Behind leaf tin, also, spongy

platinum is, in like manner, strongly heated. Through a thin membrane of gutta percha, such as is obtained by evaporating a slight layer of it from a solution in chloroform, hydrogen likewise passes: but hydrogen gas does not sensibly pass through pellicles of blown glass, however thin they may be."

WALKER'S PATENT HYDRAULIC ENGINE.

Sir,—Agreeably to the promise I made you some time back, of communicating the results of the working of my patent hydraulic engine, (fully described at page 146 of your 49th volume), I now proceed to state a few facts, and only regret that the peculiar circumstances, hereinafter described, have so limited my opportunity for procuring the information I desired.

The hydraulic engine referred to was erected for the Parliamentary Commissioners for draining, in the parish of Runham, in Norfolk; the quantity of land drained by it, is upwards of five hundred acres. A considerable portion of this is high land, and is under-drained into the lower level, and every drop of the water has to be lifted by the engine, to a height of from 4 to 9 feet, according to the height of water in the ditches, state of the tide, &c., &c. There is no natural outfall whatever, which of course adds to the cost, besides which the rain water accumulates much faster in the high land than from the low land.

In all cases, where possible, the water from the high lands should be carried off by a natural outfall; in the present instance, however, the dividing drain is too low, and the drain to the river would require to be nearly a mile long: in consequence of which, the Commissioners determined upon having all the water taken out by the engine.

There are upwards of seven miles of drains intersecting the low lands, varying from four to ten feet wide, and from three to five feet deep. All the principal drains are of the first class, and one of them, a mile in length, leads direct to the engine-house. For several weeks previous to, and during the time the engine was being put up, it rained incessantly, so that all the drains overflowed, covering the low lands in many places from a foot to eighteen inches in depth—the engine-house appearing to be situate in the midst of an enormous lake. As soon as all was ready, the steam was turned on, and the engine started; after working four days and four nights, without any intermission, the valley began to look green again. In four days and nights more the water was lowered three feet in the principal drains; we therefore took the opportunity of stopping the engine, *for the first time after turning on the steam*, and making some little necessary adjustments.

Contemplating a few days' rest, I set about measuring the drains, so that when they were again filled, and the engines started, I might get at the work done and the coals used. But on examining the drain which divides the high from the low land, I found a number of large under drains delivering such torrents of water, that the plan I had proposed to follow would be useless.

I therefore started the engine, and having weighed one ton of coals, I left the farm servant, who looks after the engine, to stoke according to my directions. This trial commenced at six o'clock on Monday evening, and continued until eight o'clock on Tuesday evening (twenty-six hours), by which time the ton of coals, costing fifteen shillings, was used up, and the fire in the same state as at starting. The speed of the engine throughout was fifty strokes per minute, and the quantity of water raised was upwards of one hundred gallons per stroke, which gives for every cwt. of coals consumed (=9d.) upwards of four hundred thousand gallons of water lifted out of the drains into the river; or eight million gallons for every ton of coals used. I do not regard this as a great performance, the engine being capable of doing more; it may be taken, however, as a minimum which may be relied upon, and will enable persons having similar tracts of land requiring draining to form their own conclusions as to the trifling cost at which it can be accomplished, and the great benefits to be derived therefrom.

I am, Sir, yours, &c.,

JOHN WALKER.

Crooked-lane Chambers,
King William-street, City,
Feb. 9, 1849.

MESSRS. HENLEY AND FOSTER'S DIVIDED POLE MAGNETS.

Sir,—Allow me to call your attention to the first claim in Messrs. Henley and Foster's patent, the specification of which appeared in your last Number. They claim the dividing the poles of any magnet into two or more poles. Now, this appears to the writer to be precisely the same as Mr. Jacob Brett's eleventh claim, and I should be glad to know how they can, by any possibility, ride through the patent of that gentleman. Messrs. Henley and Foster's improvements depend entirely upon the result they obtain from a truly ingenious application of the double energy arising from the simultaneous attraction and repulsion of both ends of their needles; that is to say, from the dividing of the poles, by which it is evident a quick and very certain motion will be obtained, while, from the position of the needle, it is not likely to get de-magnetized—two considerable improvements which, if shown by use upon a long line to answer, may be destined ere long to supersede completely the present diamond needle, in the same way as that superseded the former long needles; and for all this, are they most indisputably indebted to Mr. Jacob Brett? It is true, Mr. Brett does not appear to have had any such valuable results in contemplation by his division of poles; but he distinctly claims the making of magnets having two south and two north poles; and it would very much gratify the writer, and, possibly, some other of your readers with whom the electric telegraph is an object of interest, to know whether Messrs. Henley and Foster can ride (as they seem to imagine) through Mr. Brett's previous patent.

I am, Sir, yours, &c.,

SCRUTATOR.

Slough, Feb. 21, 1849.

[We have referred to Mr. Brett's 11th claim, but find nothing in it to countenance the charge of misappropriation insinuated by our correspondent against Messrs. Henley and Foster. What Mr. Brett claims, is the making of magnets with "two south poles *or* two north poles." We should have been inclined to treat the "or" as a clerical error, from the manifest absurdity which it implies, were it not that Mr. Brett is at pains to show, by a drawing, that a magnet with both poles south or both north [! ! !] is what he really means, and not a magnet with each pole divided in the way proposed, for the first time, we believe, by Messrs. Foster and Henley.—ED. M. M.]

ON THE ELASTICITY AND STRENGTH OF SPIRAL SPRINGS, AND OF BARS SUBJECTED TO TORSION. BY JAMES THOMSON, JUN., M.A., COLLEGE, GLASGOW.—(CONCLUDED FROM P. 162.)

[From the *Cambridge and Dublin Mathematical Journal*, Nov., 1848.]

The equations (1) and (2), together with (3) or (4), involve the various circumstances connected with the elasticity and strength of ordinary spiral springs. For enabling us to determine, by means of these equations, the actual amounts of any of the variable quantities concerned, when a sufficient number of the variable quantities have been already fixed upon in accordance with the purposes to be effected; the constant coefficients θ and μ for the substance must be determined by experiment.

Without, however, knowing the actual amounts, we may, by interpreting the equations, arrive at many useful conclusions for the comparison of the properties of springs constructed of the same substance, but having various dimensions. From (1) we see that—

1st. If r, the radius of the bar, and a, that of the coil, be fixed, the elongation produced by any weight, w, will be proportional to l, the length rolled up to form the coil.

2nd. If a bar or wire of a certain length and radius be given to form a spring, the elongation produced by a certain weight, w, will be proportional to the square of the radius which we may adopt for the coil.

3rd. If the radius of the bar be fixed, and the length of the spring when closed so that the coils may touch one another, or what is the same, the number of coils be also fixed; l must be proportional to a; and therefore, the elongation due to a weight, w, will be proportional to the third power of the radius which we may adopt for the coil.

4th. If the length of the bar and the radius of the coil be fixed, the elongation due to a weight, w, will be inversely proportional to the fourth power of the radius of the bar which we may adopt.

5th. With a given weight of metal and a given radius of the coil, the elongation due to a weight, w, will be proportional to l^3, or inversely to r^6, since l must be proportional to $\frac{1}{r^2}$.

From (4) we see that the ultimate elongation is,

1st. Proportional to the length of the bar, if the radius of the bar and that of the coil be fixed.

2nd. Proportional to the radius of the coil, if the length and the radius of the bar be fixed.

3rd. Inversely proportional to the radius of the bar, if the length of the bar and the radius of the coil be fixed.

From (2) we perceive that the absolute strength of the spring, being independent of the length, is proportional to the third power of the radius of the bar, if the radius of the coil be fixed; and that it is inversely proportional to the radius adopted for the coil, if the radius of the bar be fixed.

By combining (2) and (4) we arrive at the interesting conclusion that the "*resilience*" of a spiral spring, that is, the total quantity of work which can be stored up in it, is independent of the form or proportions of the spring, and is simply proportional to the quantity of metal contained in the coil. For, since the weights producing any elongations are proportional to those elongations, it follows that the resilience is $=\frac{1}{2}$ W.E.

Hence, by (2) and (4), we find that the resilience is $=\frac{1}{4}\theta\mu^2 lr^2$, which, since θ and μ are constant, is proportional to the volume of the coil or to the weight of metal composing it.

Many other relations might be deduced in similar ways, but those already pointed out will suffice, as others will be readily perceived when they may be wanted, by properly interrogating the formulas.

For determining the values of μ and θ for iron wire, such as is commonly used for making spiral springs (called charcoal spring wire); a spring constructed of this material was subjected to careful measurement and experiment, and the following data were obtained:

$$\text{Dimensions of the spring}\begin{cases} r = \cdot 0923 \text{ ins.} \\ l = 215\cdot 6 \;\;,, \\ a = 1\cdot 315 \;\;,, \end{cases}$$

When the spring was successively loaded with weights, each four pounds heavier than the one before; it was found that 56 pounds was the weight which just commenced to produce a permanent elongation, and the elongation corresponding to this weight was observed to be 16·9 inches. By the method which had been employed for bending the wire into the spiral form, and for separating the coils so that they might not press on one another when the spring was unloaded, the wire had been put into the condition which it would have received by having been twisted beyond the original elastic limit, that condition, namely, in which nearly all the particles in its section would come to be strained to the utmost at the same time. Hence, according to the notation which has been adopted, this ultimate weight and elongation must be denoted by W′ and E′; which, by the principles given in a former paper, already referred to, will be such that

W′ shall be equal to, or rather less than, $\frac{4}{3}$W,

and E′ equal to, or rather less than, $\frac{4}{3}$E.*

By taking W′, μ', and E′, for W, μ, and E in equations (2) and (3), we get

$$W' = \frac{\mu' r^3}{a} \text{ and } E' = \theta\,\frac{l\,W' a^2}{r^4};$$

From which, by the foregoing experimental data, we obtain

$$\theta = 0\cdot 000{,}000{,}059\dagger \text{ and } \mu' = 94{,}000.$$

But μ' is equal to, or rather less than, $\frac{4}{3}\mu$. Hence

$$\mu = 70{,}000, \text{ or rather more.}$$

The values here assigned to θ and μ will, I think, be found quite sufficiently accurate for all practical purposes; especially as the metal, in other cases, cannot be assumed to be of exactly the same quality as that used in the present one. The experiment from which these values have been deduced is the only one I have as yet been able to make; I hope, however, as soon as circumstances may permit, to carry out a consecutive series of comparative experiments with springs of various dimensions and forms and of several different kinds of metal, and also to make corresponding experiments by subjecting to direct torsion, bars similar to those forming the springs. In this way would be found the amount by which the coefficients may vary in accordance with different circumstances; and, in applying the formulas afterwards to any particular case, we should

* If we could be sure that the twisting of the wire, before the experiment, had been sufficiently great, it might be stated with certainty that W′$=\frac{4}{3}$W, and E′$=\frac{4}{3}$E. The uncertainty in this respect, though it cannot much affect the resulting value of μ, is the greatest to which the present determination of the coefficient μ is subject.

† It may here be observed that for the determination of θ the extreme weight and elongation W′ and E′ should not have been used, unless it had been found that these would lead to the same results as any smaller weight and elongation w and e. It was however found, as has been already stated, that the elongations were throughout proportional to the weights applied; and therefore it is a matter of indifference what weight and corresponding elongation we adopt for the determination of θ.

be able to choose such values of the coefficients as might appear most suitable; or at least we should know what degree of dependence ought to be placed in results obtained by applying the formulas to such cases. If a spring having the radius of the bar very small compared to that of the coil, and having the angle of its spiral as small as possible, were used, there can be no doubt but that the coefficients so obtained would agree very closely with those deduced from experiment by direct torsion.

Before concluding, I shall now merely remark that, according to the principles already given, spiral springs should always be made of bars of circular section, since such bars have a much greater resilience* when subjected to torsion than others whose section is different. Thus we see that the rectangular section which has been frequently adopted in large spiral springs for railway carriage buffers is very disadvantageous. It has probably been derived from the idea that the bar is subjected to a transverse strain; an idea which, however erroneous, is the one that usually presents itself to persons considering in a cursory manner the action of spiral springs.

* The meaning of the term "*resilience*" was before stated to be the quantity of work which can be stored up in the material, by giving to it its utmost change of form.

ELECTRIC CLOCKS.—MR. APPOLD'S IMPROVEMENTS.

Sir,—Amongst the many proposed adaptations of electricity to practical uses, the electric clock holds a somewhat prominent place, though down to the present moment it can hardly be said to have been productive of any real advantage. The inconstancy and varied intensity of the power applied to move the pendulum, continually destroys its regularity as a time-piece—variations frequently occurring from this cause to the amount of nearly 20″ a-day. Some very curious effects have also shown themselves in reference to the retarding action of the magnets and current upon the pendulum. Experiment shows that when both magnets and current are removed, the pendulum in vibrating from a given arc to a quiescent position requires 22′ 17″ (mean observation); but that a retarding action becomes manifest on the interposition of the magnets, the time being reduced to 8′ 8″ mean, which again becomes lessened by permitting the current to permeate the coil surrounding the pendulum to 4′ 40″, showing the interference of a considerable retarding force during the action of the clock—a force of course influenced by a variation in quantity and intensity of the current derived from the battery. From this cause, combined with the fact of the pendulum receiving a portion of the current during every vibration, arises the irregularity already noticed; the arc of vibration being of course accelerated or retarded in proportion to the impetus and duration of each successive portion of current taken up by the pendulum. From some very accurate and comprehensive experiments extending over a period of eight months, made by Mr. G. Appold, during which time the action of the clock, under the influence of a varied battery, was rated by a chronometer, that gentleman was led to form a self-adjusting compensation, by means of the pendulum, which allows the current to flow only when required, and then only in such quantity as becomes necessary to restore the pendulum to its mean vibration. The adjustment is effected with such delicacy that the variation of intensity or quantity in the battery has no effect upon the going of the clock. The pendulum, in all cases when not requiring further impulse, swings free from the action of the current—the break-piece being lifted off and carried over the connections. But upon any current requiring to be taken up, it falls short of the carrier, and in proportion to the impulse required, is the amount of current imparted. In this way, by observation upon a galvanometer, the pendulum may be seen to swing, consecutively, 10, 12, or more vibrations, without receiving additional impulse; while, perhaps, upon the 13th beat, the galvanometer may indicate a small amount of current. From this it will be readily seen, that Mr. Appold's experiments have originated a most important improvement in the electric clock; for whereas the battery and clock were formerly always, during each beat, in connection for a time with each other, they now act independently of each other, and are united only at such times and in such degree as becomes necessary for their mutual action, the variable force of

the battery being likewise compensated by the amount of sustained contact.

MATTHEW J. HOLMES.

Hampstead, Feb. 28th, 1849.

STENSON'S IMPROVED STEAM BOILERS.—EVANS'S BOILER FLOAT.

Sir,—At the York Agricultural Meeting, last summer, there was exhibited by Messrs. Sharman and Co., a steam boiler, for cooking purposes, made by me, for W. P. Stanley, of Peterborough; precisely (with the exception of the bent pipe through the fire box) in its construction like the one shown in fig. 28 of No. 1331 of your Journal, as one of "Stenson's Patent Improvements in Steam Boilers." At the time it was made, I was quite ignorant of anything of the kind being in existence; but Mr. Stenson kindly informed Mr. Stanley that it was an infringement of "Beale's Patent." It was in consequence withdrawn from competition. It has, however, been since in use by Mr. Campton, of Water-Newton, near Peterborough. I enclose you a communication from Mr. Stenson to Mr. Stanley, upon the subject, and in consequence of which, I discontinued making them. Stenson's fig. 28 is a copy of this very boiler; and fig. 24 is a modification of the same, with the smoke jacket patented by Barratt, Exall, and Andrews, of Reading, added thereto. This last also was at the York show.

I observe, amongst the "Recent American Patents," recorded in this same Number, one for a float in a cylinder, separate from the boiler, and communicating therewith by pipes above and below the water-level. This I have been constantly making for the last eight months, more particularly of late, to Stanley's cooking apparatus, one of the earliest of which was for the Duke of Bedford, at the Park Farm, Woburn.

I did not consider it at the time an invention, but applied it simply because there is not room in the boiler itself for a float.

I have adopted both the stone and copper ball float. The copper one, with Lambert's patent lever valve cork, has not been seen by me anywhere else.

I am, Sir, yours, most obediently,

JOHN MEDWORTH.

Mr. Stenson to Mr. Stanley.

Northampton Foundry,
Commercial-street,
July 24, 1848.

Dear Sir,

I promised to write you (when we were examining your boiler at York), and on referring to the *Mechanics' Magazine* for November 4, 1843, you will find a woodcut and description of "Beale's Patent Boiler," which is also accompanied with "Beale's Rotary Engine." I called, on my journey home, at Rotherham, and saw the *identical boiler* from which that drawing and description were published. It was at Yates' Works. I have sent you this, in order that you may not get into any litigation for infringement of a patent-right—as, if the boiler should get under the patentee's observation, some quibbling might be the result.

I am, Dear Sir,
Yours respectfully,
H. STENSON.

[We think our correspondent, Mr. Medworth, has not duly appreciated the differences between Mr. Stenson's boiler and Mr. Beale's. We may mention at once those features of novelty which appear to ourselves to sustain sufficiently Mr. Stenson's claim to originality. First: there is the bent pipe (K), which Mr. Medworth admits to be new; this is, undeniably, an addition of the greatest consequence, serving, as it does, to obviate that liability to over-heating and cracking to which all tube plates not so protected are subject. Next, there is the placing of the smoke-box within the steam chamber of the boiler, for the purpose of drying the steam; this is another contrivance of great practical value, nothing like to which is to be found in Beale's. We are satisfied to rest our justification of the favourable opinion we have expressed of Mr. Stenson's boiler on these two improvements alone; but there are several others, though of a minor character, which we leave to Mr. Stenson himself to point out in the reply which he will, no doubt, feel called upon to make to Mr. Medworth's communication. One word as to Mr. Stenson's letter to Mr. Stanley. It may very well be, that Stanley's boiler was like to Beale's, and yet perfectly true, at the same time, that Mr. Stenson's is materially different from both.—ED. M. M.]

THE ELECTRIC LIGHT.

(Extract from Report in the *Literary Gazette* of a Lecture delivered by Professor Grove, at the Royal Institution.)

Mr. Grove made some experiments six years ago on the subject, and then on one occasion delivered a lecture at the London Institution, when the theatre was illuminated by the voltaic arc. In preparing the present lecture, he had made a rough calculation as to its expense, and the matter appeared to him (though attended with many practical difficulties) to be hopeful and promising. By interposing a voltameter in the circuit while the arc was produced, the consumption in the battery could be calculated; for every chemical equivalent of hydrogen evolved in the voltameter an equivalent of zinc, of sulphuric acid, and one-third of an equivalent of nitric acid would be consumed in each cell of the battery. Supplying these data for calculation, and making proper allowance

for the amount of water contained in the commercial acids, &c., the theoretical expense of a battery such as he was exhibiting (fifty cells of the nitric acid combination, each platinum plate two inches by four) would be about two shillings an hour.

He had tested by the photometric method of equality of shadows the intensity of the light as compared with a common wax candle, and found that after the battery had been an hour at work, the voltaic light was to the candle as 1444 to 1. He did not take this comparison of intensities as an absolutely fair practical comparison, nor did he give the above as a practical calculation, but thought it would be safe if twice that expense, or four shillings per hour, were assumed; the actual expense of charging the battery for a given time of action bore this out. He showed the inferiority of central as compared with separate lights for street illumination; but for light-houses, particularly for an intermittent light at regular intervals, or for signal lights, the application appeared to him to be reasonably approximate, and for more general purposes, far from hopeless—the practical difficulties, though undoubtedly not small, being, in his opinion, by no means insurmountable.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING FRIDAY, MARCH 2.

WILLIAM YOUNG, plumber, and HENRY BURGESS, engineer, both of Barnstaple, Devon. *For improvements in smelting and refining lead ores.* Patent dated August 28, 1848.

These improvements relate to the condensation of the vapours which escape from the furnaces employed in the manufacture of lead from ore, the object being to obtain therefrom the litharge and other oxides, which are carried off mixed with the products of combustion.

For this purpose the patentees first cause the flue from the furnace to pass through a steam boiler flue, so that the waste heat may be used in generating steam; the flue then opens into a fan by which the vapours are projected down upon the surface of a large closed tank of water. A great portion of the metallic compound is then mixed with the water. The vapours next pass from the top of this tank into another flue, into which there is projected a strong jet of high-pressure steam from the boiler above mentioned.

The combined steam and vapours are then made to pass successively through a series of chambers, the opening from the one to the other being through finely perforated plates of metal. The gravity of the particles of oxide is increased by the steam, and they collect upon the floors of the chambers.

Connected with the large tank of water there is a smaller cistern placed outside, by which the height of the water inside the chamber is regulated, and, consequently, the distance of the surface of the water in the tank from the mouth of the descending flue, can be readily ascertained, and the pressure be regulated accordingly.

The patentees claim,

1. The employment of a water lute which may be regulated by raising or lowering the water in the cistern, whereby the draught will be regulated, and an economy of fuel effected.

2. The causing the metallic particles, which escape from the furnace, along with the smoke, to pass through water, and then through finely perforated plates into vaults filled with steam; the condensation and collection of the metallic particles.

3. Applying these processes in the smelting of lead, for collecting white and blue oxide of lead in a paste.

4. Causing the metallic particles, if any, which may remain with the smoke after the second process, to pass through the body of the furnace, and again to undergo that process; a complete collection of the metallic particles.

ALFRED VINCENT NEWTON, of Chancery-lane, Middlesex. *For certain improvements in dressing or cleaning grain, and in separating extraneous matter therefrom.* (Being a communication.) Patent dated August 22, 1848.

Claims.—The cleaning and dressing of grain or seed by the application of attrition to it while in a moist state; the application of a current of atmospheric air, or heated air, to separate the foreign or extraneous matters from the grain; and the peculiar arrangement of apparatus for carrying these two operations into effect.

ALONZO BUONAPARTE WOODCOCK, Manchester. *For improvements in steam engines, and in apparatus for raising, forcing, and conveying water and other fluids.* Patent dated August 22, 1848.

Claims.—1. The application of one or more rings of a cylindrical or any other convenient form, and composed of vulcanised caoutchouc, or any suitable elastic material, as rolling packing to pistons and stuffing-boxes of steam-engines.

2. The application of rings of the same form and materials to the pistons or buckets of pumps.

3. The application of rings of the same

materials to barrels or cylinders of cocks or valves.

4. The lining or making the barrels or cylinders of pneumatic or hydraulic machines of any suitable elastic materials.

Edward Dench, of Hursterpoint, Sussex (now of King's-road, Chelsea), hothouse builder. *For improvements in the roofing of conservatories, hot-houses, and other like structures.* Patent dated August 26, 1848.

The improvements which form the subject of this patent are stated to consist, *firstly*, in so constructing the roofs of conservatories, hot-houses, and other like structures, that they may afford protection to the plants, not only from wet and cold from without, but from the descent of the vapours which collect and condense on the inner or under surfaces, and so also that they may afford any degree of ventilation required. *Secondly*, in making the fixed and sliding parts, of such shape and materials, that they may fit more exactly, move one upon the other more easily, suffer less from changes of temperature, offer less obstruction to the light, and remain longer in good working order than heretofore.

Instead of forming the styles, astragals, and other parts of frames, of wood, as usual, which is exceedingly liable to shrinkage and decay, the present patentee makes them of galvanized or zincked iron, rolled, hammered, or bent into certain peculiar forms, represented in, and only to be understood by inspection of the drawings attached to the specification. We can only say of these forms generally that they seem well calculated to effect the important objects which the inventor has proposed to himself.

Claim.—The constructing of the styles, rails, astragals, and other parts of the framework of the roofing of conservatories, hot-houses, and other like structures, of the peculiar forms and combinations of forms represented in the drawings.

Alexander Angus Croll, of the Gas Works, Tottenham. *For improvements in the manufacture of gas, and in apparatus to be used in transmitting gas.* Patent dated February 22, 1848.

The first of these improvements relates to such retorts as are supplied with coal from both ends. In these retorts it has been the practice to supply the coal first to the one end, and when this charge has been partially exhausted of the gaseous products, to throw in a supply at the other end. It has been also the practice in such retorts to have a pipe for carrying off the gas attached to each end of the retort. Mr. Croll has found that it is attended with great saving to supply the charge to both ends at the same time, and to have only one pipe to carry off the gaseous products, and in these alterations consist the first of the improvements now patented.

A second improvement consists in the introduction of a jet of steam through and amongst some carbon or coke, which is kept in an incandescent state at the end of the retort, opposite to that by which the gas produced from the coal is escaping. The products of the steam and carbon are thus made to unite with the gas as it is generated, and the illuminating power of the gas thereby greatly improved.

A third improvement consists in causing the impure gas, as produced from the retorts, to pass through several vessels arranged on the principle of Wolf's apparatus, and filled with water charged with sulphurous acid. The sulphur of the sulphuretted hydrogen contained in the gas unites with the sulphur of the sulphurous acid gas, with which the water in the vessels is charged, whereby the gas is purified from sulphuretted hydrogen, and the sulphur which is regenerated from the combination is obtained in the form of flowers of sulphur.

A fourth improvement relates to a means of keeping the gas in a gas holder situate at a great distance from the gas manufactory, at the same pressure as the gas in the pipes intervening between the works and the gas holder. The exhausting apparatus employed for charging the gas holder has a "regulator" connected to a pipe, joining the gas holder with the gas main at some point in advance of the exhauster. By this arrangement, the exhauster is prevented from reducing the pressure of the gas in the mains too low for the supply of the consumers situated in the intermediate distances, between the gas manufactory and the distant gas holder.

Claims.—1. The simultaneous charging of long retorts at both ends, as described.

2. The introduction of steam into the retorts for improving the illuminating power of the gas.

3. The using of sulphurous acid gas for purifying gas. And

4. The apparatus described for facilitating the distribution of gas.

Peter Wright, of Worcester, Dudley, vice and anvil manufacturer. *For certain improvements in the manufacture of vice boxes.* Patent dated August 31, 1848.

The improved vice boxes of Mr. Wright have the screw threads cut out of the solid metal of which the box itself is formed, instead of their being soldered into it, as has been heretofore the practice. The patentee forges the box in the first instance, in the usual way, and then bores it right through

from end to end. The box, in this state, is fixed in a machine, somewhat similar to a boring machine, being, in fact, an upright screwing machine. The screw-cutting tool consists of a single cutter inserted into a slot in the spindle of the machine, which cutter is capable of being made to project, more or less, beyond the surface of the bar, at pleasure. The upper end of the spindle has a screw thread cut upon it, corresponding to the thread intended to be cut in the vice box; by this means the thread is cut in the box, exactly in the same way as large nuts are screwed. Sometimes the patentee forges the vice box in one piece, with the fixed jaw of the vice, instead of having it inserted afterwards. The vice boxes thus formed require to have the further ends closed by a plug, to prevent the screw getting clogged.

Claims.—1. The constructing the thread of vice boxes out of the same piece as the box itself, and the making the vice box in one piece with the jaw. And,

2. The machine, or its equivalent, when applied for the purposes aforesaid.

CHARLES ROWLEY, of Birmingham, button manufacturer. *For improvements in the manufacture of buttons.* Patent dated August 28th, 1848.

The first of these improvements consists in the construction of dies and die boxes, for cutting, punching "sewn-through metal buttons." The punches, &c., are arranged upon and attached to the descending or moveable portion of the apparatus, in the following order: there is, first, a cutting-off tool; second, a punching-tool, which cuts out the entire button; third, a countersinking-tool; and, fourth, a punching-tool, which punches the holes for sewing on the buttons by. On each descent of the upper portion of the dies there are, by this means, performed four operations; first, the cutting off the end of the strip of metal out of which the buttons are being formed; second, the punching out of an entire button from the strip; third, the countersinking of the holes in a second button; and, fourth, the punching the holes in a third button.

A second improvement consists in the application of the lapidary's art, to finish buttons made of ivory, bone, vegetable ivory, wood, and porcelain, so that they may have the appearance which is now given to glass buttons, finished by the same process, namely, having the surface consisting of a number of angular and regular facets or projections.

A third improvement consists in the construction of leek buttons, with metal shells and flexible shanks.

A fourth improvement consists in the construction of "sewn-through" buttons, by combining metal discs with those of ivory, horn, wood, &c.

A fifth improvement consists in pressing the front surface of buttons covered with velvet into moulds or dies, so that the pile of the fabric may have compressed upon it any device or ornament.

A sixth improvement consists in the construction of dies for facilitating the manufacture of covered buttons,—having principally reference to the putting on of the metal discs.

A seventh improvement is the construction of a metal "sewn-through" button, which is formed of a disc, the edges of which are in the first instance raised up all around, by its being pressed in a mould. A piece of wire, about the length of the internal diameter of the cup so formed, is then inserted into it, and the raised edges are finally pressed down upon the body of the disc, which makes a finish around the edges, while the piece of inserted wire serves as a hold for the thread by which it is sewn upon the garment.

An eighth improvement consists of an arrangement of machinery for cutting out the cloth for covered buttons, by which a great saving of material is effected, and which consists of certain contrivances by which the cloth is made to travel in an angular direction through the machine,—thus causing the circles cut out to leave very little waste cloth between them; one row of circles interlocking into or taking an intermediate space between those of the other row.

The patentee's claims, which are eight in number, embrace the subjects of the eight different improvements before enumerated.

HUGH LEE PATTISON, of Washington-house, Gateshead, Durham, chemical manufacturer. *For improvements in manufacturing a certain compound, or certain compounds of lead, and the application of this and certain other compounds of lead, to various useful purposes.* Patent dated August 22, 1848. (No specification enrolled.)

ELIZABETH CHREES, of Homerton Castle, Homerton, Middlesex. *For improvements in the manufacture of sealing-wax.* Patent dated August 29, 1848. (No specification enrolled.)

FRENCH PATENTS.

The *Moniteur* contains the following important notification relating to French patents of invention:—

(*Translation*)

"The President of the Republic.

"On the Report of the Minister of Agriculture and Commerce,

"Taking into consideration the law passed on the 5th of July, 1844, relative to patents of invention, and also the decree of the 25th February, 1848, whereby patentees who, since the 22nd of the said month, had not been able to pay in Paris the annuities on their patents within the time fixed by the law of the 5th July, 1848, were to be exempted from the forfeiture of their patents thereby incurred, if they paid such annuities before a certain date to be thereafter named, Decrees—

"*First*. That the decree of the 25th Feb., 1848, shall cease to have effect after the 1st July, 1849.

"All annuities which may have become due since the 22nd Feb., 1848, must be paid before the said date (1st July, 1849.)

"All patentees whose annuities shall fall due within the above-named time, shall also be allowed till the 1st July, 1849, to pay the same.

"*Second*. The Minister of Agriculture and Commerce is charged with the execution of the present decree, which is to be published in the *Bulletin des Lois* and in the *Moniteur*.

"Given at the Palace of the Elysée-National, the 23rd February, 1849.

"L. Napoleon Bonaparte.

"*The Minister of Agriculture and Commerce*,

"L. Buffet."

WEEKLY LIST OF NEW ENGLISH PATENTS.

Amedee Francois Remond, of Birmingham, for improvements in machinery for folding envelopes, and in the manufacture of envelopes. February 28; six months.

William Brindley, of Twickenham, papier mache manufacturer, for improvements in the manufacture of waterproof paper. February 28; six months.

Charles Jacob, of Nine Elms, Surrey, engineer, for improvements in the manufacture of earthenware tubes or pipes. February 28; six months.

Dion de Bourcicault, of the Quadrant, Regent-street, gentleman, for certain improvements in the mode or modes to be used for transmitting and distributing liquids and fluids for agricultural purposes, and for apparatus connected therewith. February 28; six months.

Thomas Rowlandson, of Liverpool, chemist, for improvements in the treatment of certain mineral waters to obtain products therefrom, and in obtaining certain metals from certain compounds containing those metals, and in obtaining other products by the use of certain compounds containing metals. February 28; six months.

Charles Andre Felix Rochaz, of New-court, St. Swithin's-lane, merchant, for improvements in the manufacture of oxide of zinc, and in the making of paints and cements where oxide of zinc is used. February 28; six months.

Pierre Isidor David, of Paris, for improvements in bleaching cotton. February 28; six months.

Job Cutler, of Spark Brook, near Birmingham, civil engineer, for certain improvements in the manufacture of metal pipes or tubes. February 28; six months.

George Fergusson Wilson, of Belmont, Vauxhall, gentleman, for improvements in separating the more liquid from the more solid parts of fatty and oily matters, and in separating fatty and oily matters from foreign matters. February 28; six months.

Clemence Augustus Kurtz, of Wandsworth, Surrey, gentleman, for certain improvements in looms for weaving. February 28; six months.

Obed Blake, of the Thames Plate Glass Company, Blackwall, Middlesex, manager, for certain improvements in the process or processes of manufacturing and finishing plate sheets or panes of glass. February 28; six months.

Joseph Barker, of Esher-street, Kennington, artist, for an improved method of constructing umbrellas and parasols. February 28; six months.

John Hick, of Bolton-le-Moors, Lancaster, engineer, and William Hodgson Gratrix, of Salford, in the same county, engineer, for certain improvements in steam engines, which improvements are more particularly applicable to marine engines, and also improvements in machinery or apparatus for propelling vessels. February 28; six months.

Benjamin Biram, of Wentworth, York, gentleman, for improvements in miners' lamps. February 28; six months.

Robert Pollard, of Topsham, Devon, rope-maker, for an improvement in rope-making machinery. February 28; six months.

Henry Crosley, of the firm of Henry Crosley, Son, and Galsworthy, of Emerson-street, Surrey, engineers and coppersmiths, for certain improved modes or methods of, and apparatus for, heating and lighting, for drying substances, and for employing air in a warm and cold state for manufacturing purposes. February 28; six months.

Perceval Moses Parsons, of Lewisham, Kent, civil engineer, for certain improvements in railways, railway engines and carriages, and certain of their appurtenances. February 28; six months.

LIST OF PATENTS GRANTED FOR IRELAND FROM THE 20TH OF JAN., TO THE 20TH OF FEBRUARY, 1849.

John Mitchel, chemist, Henry Alderson, civil engineer, and Thomas Warriner, farmer, of Lyons Wharf, Upper Fore-street, Lambeth, Surrey, for improvements in smelting copper. February 14.

William Clay, of Clifton Lodge, Cumberland, engineer, for certain improvements in machinery for rolling iron or other metals, parts of which improvements are applicable to other machinery in which cylinders or rollers are used. February 14.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 19TH OF JAN., TO THE 22ND OF FEBRUARY, 1849.

William Martin, of St. Pierre les Calais, France, mechanist for certain improvements in machinery for figuring textile fabrics, part of which improvements are applicable to playing certain musical instruments, and to printing and other like purposes. Sealed January 24; six months.

Joseph Deeley, of Newport, Monmouth, en-

gineer and iron-founder, for improvements in ovens and furnaces. January 24th; six months.

Alexander Parkes, and Henry Parkes, of Birmingham, for improvements in the manufacture of metals, and alloy of metals, and in the treatment of metallic matters with various substances. January 31; six months.

Laurence Hill, Jun., of Motherwell Iron-Works, near Hamilton, Lanarkshire, civil engineer, in consequence of a communication from Henry Burden, of Troy, in the United States of America, for improvements in the manufacture of iron, and in the machinery for producing the same. January 31; six months.

Francis Hay Thomson, of Hope-street, in the city of Glasgow, North Britain, M.D., for an improvement in smelting copper and other ores. February 2; four months.

Ewald Riepe, of Finsbury-square, in the county of Middlesex, merchant, in consequence of a communication from Antoin Lohage, residing abroad, and partly by invention of his own, for improvements in the manufacture of soap. February 5; six months.

David Napier, and James Murdock Napier, of the York-road, Lambeth, engineers, for improvements in mariners' compasses, also in barometers, and in certain other measuring instruments. February 5; six months.

Rees Reece, of London, chemist, for improvements in treating peat, and obtaining products therefrom. February 5; six months.

Edmund George Pinchbeck, of Fleet-street, London, for improvements in certain parts of steam-engines. February 5; six months.

James Robertson, of Great Howard-street, Liverpool, Lancaster, cooper, for improvements in the manufacture of casks and other wooden vessels, and in machinery for cutting wood for those purposes. February 5; four months.

Fennell Allman, of 18, Charles-street, St. James's-square, Westminster, consulting-engineer, for improvements in apparatus for the production of light from electricity. February 7; four months.

Achille Chaudois, of Paris, France, manufacturing chemist, for improvements in extracting and preparing the colouring matter from orchil. February 7; six months.

Thomas De la Rue, of Bunhill-row, Middlesex, manufacturer, for improvements in producing ornamental surfaces to paper and other substances. February 9; six months.

Jonah Davies and George Davies, of the Albion Iron Foundry, Tipton, Staffordshire, iron-founders, for improvements in steam-engines. February 9; six months.

Samuel Brown, the younger, of Lambeth, Surrey, engineer, for improved apparatus for measuring and registering the flow of liquids, and in substances in a running state, which apparatus are in part also applicable to other useful purposes. February 12; six months.

Hugh Bell, of London, Esquire, for certain improvements in aërial machines and machinery, in connection with the buoyant power produced by gaseous matter. February 19; six months.

William Clay, of Clifton Lodge, Cumberland, engineer, for certain improvements in machinery for rolling iron or other metals, parts of which improvements are applicable to other machinery in which cylinder rollers are used. February 19; six months.

Clarey M'Clellan, of Larch Mount, in the liberties of the City of Londonderry, for an improved corn-mill. February 20; four months.

Emanuel Miller, of Baltimore, Maryland, in the United States of America, gentleman, for certain improvements in dressing or cleaning grain, and in separating extraneous matters therefrom. (Communication.) February 21; six months.

James Baird, of Gartsherrie, in the parish of Old Monkland, Lanark, Scotland, iron-master, and Alexander Whitelaw, of Gartsherrie Iron Works, parish and county aforesaid, manager of said works, for improvements in the method or process of manufacturing iron. February 21; four months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subject of Design.
Feb. 23	1788	George Shardlow	Nottingham	Body Gauge.
24	1789	Edouard Beimer	Peter-street, Westminster	Spring lever for spring hats.
,,	1790	Sabrina de Caulier	Coleman-street	Shirts or under garments for males and females of all ages.
,,	1791	Robert and William Wilson	Wardour-street	Shower bath.
,,	1792	William Wilson	Manchester	Triple bath-tap.
26	1793	James Badcock	Downham-road, London	Hook for fastening garments.
27	1794	Edward Bird	Birmingham	Lamp for railway carriages.
,,	1795	Charles Eagle and John Egginton	Birmingham	Fastening for articles of dress.
March 1	1796	John F. Clark	Wolverhampton	Remington and Clark's elastic bed-laths.

NOTICES TO CORRESPONDENTS.

A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the Claims of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d. Post Office Orders to be made payable at the Strand Office, to Joseph Clinton Robertson, of 166, Fleet-street.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, b Joseph Clinton Robertson, of No. 166, Flee street, in the City of London.—Sold by A. an W. Galignani, Rue Vivienne, Paris; Machin an Co. Dublin; W. C. Campbell and Co., Hamburgh

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1335.] SATURDAY, MARCH 10, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

FONTAINEMOREAU'S PATENT VENEER-JOINING MACHINERY.

Fig. 8.

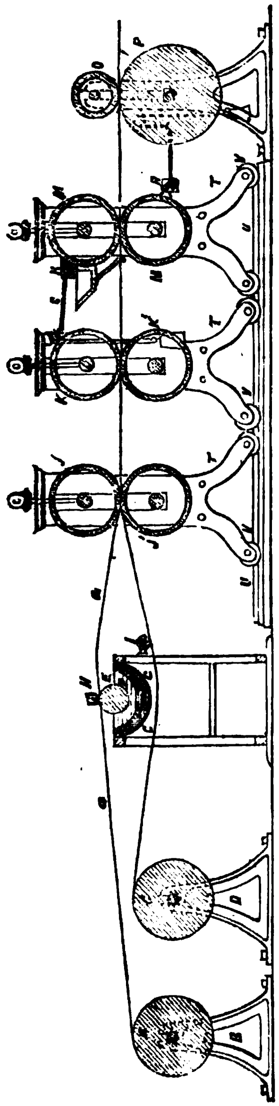
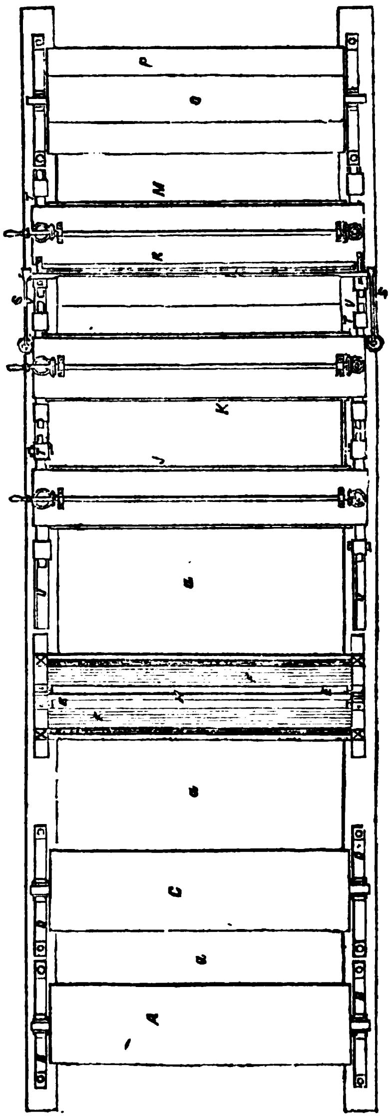


Fig. 9.



MR. FONTAINEMOREAU'S PATENT VENEER-JOINING MACHINERY.

(Extract from Specification continued from p. 198.)

Description of Apparatus for pasting and laying thin Sheets of Wood together.

The application of sheets of veneers to several useful purposes, and especially to cabinet-making, is well known, but until now on account of the processes, for cutting the wood into veneers having only produced sheets of small dimensions, the manufacturer has been very limited in their use and application, as he could not lay on or cover large surfaces by a single and same sheet.

This is obviated by means of the wood, cutting machine before described, for cutting logs into extremely thin sheets, of an almost indefinite breadth, so that such new mode of producing veneers naturally offers several easy and useful applications of those sheets, not only for veneering in general, but also for hangings, floorings, carpeting, &c., which they can replace with the greatest success.

These sheets can be advantageously employed for decorating apartments, halls, &c., &c., instead of paperhangings, painting, or carpets. They present the double advantage of being richer, more durable and brilliant, warmer and healthier than paper; with such hangings of thin wood, it will be easy to clean their surfaces without altering or wearing out any part of them. On the contrary, they will be rendered handsomer by continual polishing, and thereby they will acquire a more imposing and sumptuous aspect.

It was necessary, to render such purpose available, and capable of its numerous applications, not only to make veneering sheets of great dimensions in breadth, and especially in length, but it was also indispensable to fix them on the surfaces which are to be covered, to lay and place them on those surfaces in a regular manner, and with the greatest required precision.

The usual veneer sheets, as obtained by the ordinary processes of sawing, are directly glued when they are to be applied on the woods which they are to cover. Instead of operating in that manner with the large sheets cut by the process before described, and to render them fit for the new applications I intend to make of them, my process is to paste them on all their width on canvass, thin cloth, or any other similar tissues whatever; by that means those thin sheets obtain a very great stability, which permits afterwards to use them with the utmost facility for veneering, covering every kind of surface, whatever may be its width and breadth.

In order to put such improvements into execution, that is to say, to lay glue perfectly well, all the surface of those large and thin slices or sheets of wood upon the tissue or cloth in such a manner that their superposition and adhesion should be complete, firm, and permanent, the hereinafter described apparatus has been found to answer in every respect.

Fig. 8 is a general plan of the machine above alluded to.

Fig. 9 exhibits a longitudinal section drawn through the centre of the apparatus, according to the line 1, 2.

Fig. 10 is a lateral elevation or view, in breadth, of a part of the apparatus.

In these engravings the same letters of reference apply to the same parts. It is easy to understand, by examining them, the general disposition of the machine and its manner of working.

The linen cloth, *a*, figures 8, 9, which is to serve as a lining to the veneer, is previously rolled over a cylinder or drum, A, the axes of which are so adjusted that they move freely in the grooves of the upper part of the cast iron supporters, B. The sheet of veneer made by the cutting machine which, as before stated, is of a great length, is also rolled over a second cylinder, C, the axes of which also move freely in their forked supporters, D. The sheet and the cloth are both at once and together unrolled from the surfaces of the cylinders, and soon meet beyond the gluing apparatus, which is placed at a short distance from the cylinder, C. That gluing apparatus consists of a cylinder or brush, E, which dives in a pan, F, filled with paste previously heated in a *balneum maræ*, or sand bath, by steam, by means of a second pan, G, which encloses it, or by any other suitable means.

That cylinder, E, receiving a continuous rotative movement, is constantly impregnated with a certain quantity of paste or glue, which it spreads in abundant quantities over the surface of the cloth or stuff, as this last passes over its circumference, and on which it is forced bare by the pressure of a sort of right angular ruler, H, set directly above it, and which at both its extremities is kept and led in grooves, O O. That ruler, H, could be replaced in case of need either by a weight or springs, or any other suitable contrivance. The veneering sheet passes only under the pasting cylinder, E, or rather, under the *balneum maræ*,

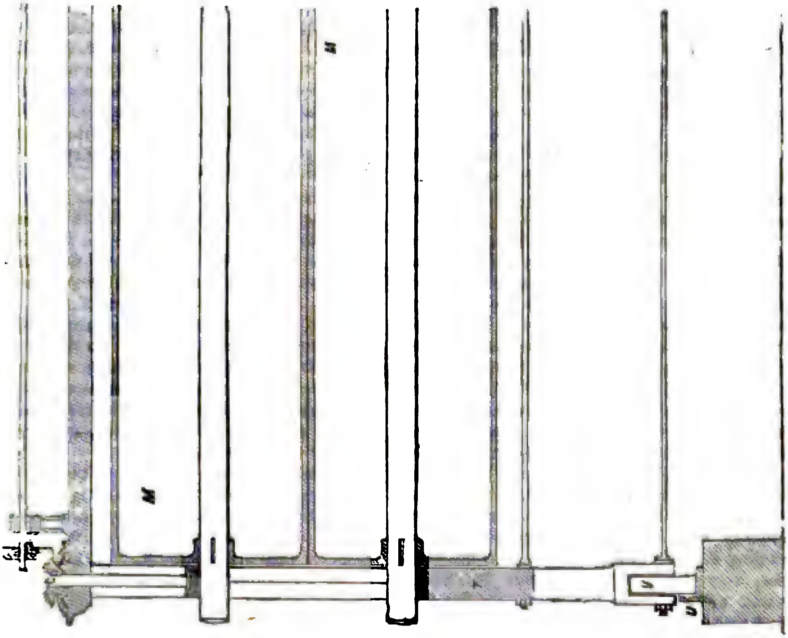


Fig. 13.

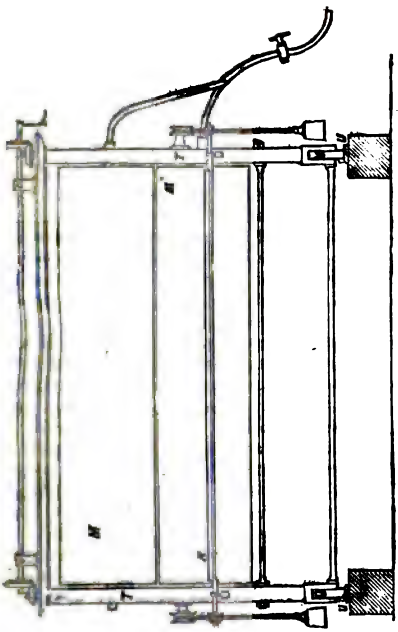


Fig. 10.

Fig. 11.

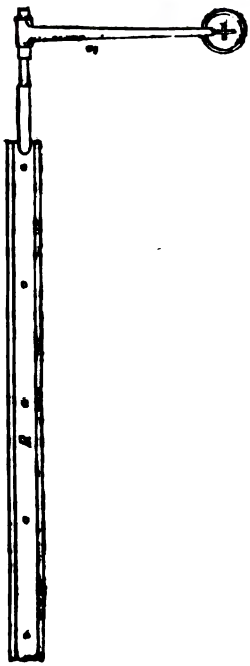


Fig. 12.

and is directed by a rod or long moveable roller, I, purposely placed on the frame, V, towards the two large and strong cylinders, J and J^1, between which it must pass at the same time as the cloth, so that they may be both sufficiently pressed together, and adhere to each other uniformly in all their length and breadth. The cylinders are so disposed that the necessary degree of pressure to ensure the complete adhesion of the cloth and sheet is given at once.

When egressing from these cylinders, the cloth and the veneering seem to form but one single body like a very thin pasteboard, but they are too wet to have a good solidity, wherefore it is necessary to dry them with the same rapidity as the pasting and uniting action has been effected by the pressing cylinders. For that purpose, it has been considered that the most convenient and rational means consisted in using steam, which is made to enter into some hollow cylinders like those long used in paper-making machines. However, as it is most essential that the drying should not be too quickly obtained, for fear either of unpasting or preventing a thorough equal pasting, care must be taken that the steam which arrives from the boiler in the two first cylinders, K, K^1, which are placed close to the pressing cylinders, J, J^1, be not too hot, and that the steam which reaches the last range of cylinders, M, M^1, be the hottest. It would be very easy, in case of need, to cause the same steam to run successively in like manner in a greater number of cylinders, in order to obtain more surely in the meantime, by that said operation, a perfect, smooth, even union, and a regular pasting and drying without any trouble or difficulty.

It is understood that the sheets of veneer being united to the cloth, passing thus from one to the other pair of cylinders, and receiving successively more and more heat, are dried gradually without any chance of being over-heated by that process; when they arrive at the last pair of heated cylinders, they are entirely dry, and form one single and only sheet, which is rolled over the drum, P, to which a convenient rotary motion is given according to the direction described by the arrow, as shown in the engraving.

As that cylinder in receiving the united veneer and cloth becomes progressively larger, it is necessary to lessen the velocity of its rotation in order to keep as much as possible rectilineal motion of the united veneer and cloth.

For that purpose that cylinder, P, is put in motion by means of a pulley, and of a distender, which bearing more or less heavily, and to the required degrees, on the strap of the pulley, causes this last to be drawn with more or less velocity, and in order that the united veneer and cloth should remain well distended over the circumference of the cylinder, P, without being unpasted, a pressing cylinder, the weight of which is evidently proportioned to the velocity, is conveniently placed above it.

To take away from the surface of the pressing and heating cylinders the superabundant paste, which, by the pressure, egresses through the sides of the united cloth and veneer, some moveable scrapers or knives, R, figs. 11 and 12, have been adapted; they are set on the axes of those cylinders, and as they bear on them, care must be taken to maintain them constantly at their proper position by means of weights suspended to levers, S, which are adjusted to the extremity of those axes, and on the outside of the machines.

To vary also, in case of need, the distance between these pressing and heating cylinders their cast-iron frames, T, have been so disposed as to allow them to roll upon two parallel bands or rails, V, figs. 10 and 12. Thus, at the feet of each of those frames are adjusted some cast-iron small wheels or rollers, V, by means of which the position of the cylinders can be easily changed, and consequently they can be made to advance or recede as it is judged convenient.

Claims.

And having now fully described the invention communicated to me, and the manner of performing and carrying out the same, I wish to observe, that I do not claim as my invention the principle of cutting wood tangentially to the cylinder in the form of a spiral or of an unfolding sheet, as that principle has been discovered since a long while. But the invention communicated to me, consists in the means before described, to effect and completely carry out that principle, that is to say, to render it available for commercial and manufacturing purposes, by cutting wood of any widths or lengths. And further, I do not confine myself, in some portions of the description, to the precise manner, means, or *modus operandi* therein detailed, provided their general features be the same as herein laid down, and described. But what I claim as new, and as the invention communicated to me, and intended to be protected by letters patent, are—

Firstly. The improved arrangement and disposition of a machine or apparatus for cutting wood into sheets of any width whatever, before described.

Secondly. The application of a thin blade

set between two longitudinal knives, as before described.

Thirdly. The application of a moveable and pressing leader, as before described.

Fourthly. The continuous progressing of the blade-bearer, and of the leader, and the apparatus producing that movement, as before described.

Fifthly. The application of a cylinder or drum for cutting wood into rectangular sheets, as before described.

Sixthly. I claim the addition to the first-mentioned machine of a cylinder provided with circular blades and washers to cut wood for matches, as before described.

Seventhly. The mode of, and apparatus for, preparing thin sheets of wood or veneers, produced by the first part of the invention, of whatever dimensions, as before described.

Eighthly. The application of the above-mentioned sheets of wood or veneer, to various useful purposes.

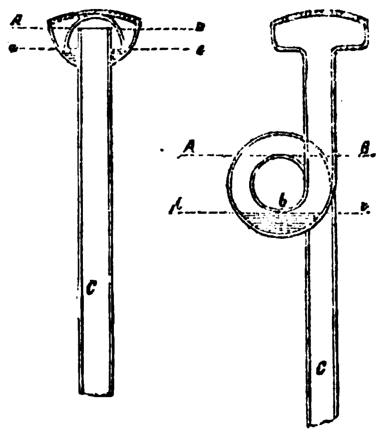
ON EFFLUVIA TRAPS.

Sir,—At page 135 of Number 1331, there is a description of "a simple effluvia trap," by Mr. John Beverley; the invention of which is claimed, at page 162 of your last Number, by Mr. John Phillips, who actually *registered* the invention in August last. Now, with all due deference to both these gentlemen, I would submit that there is no *invention* in the case; that the thing is a *fallacy*, and this effluvia trap, like many others, is a "trap" in every sense, except in the sense intended.

It is undoubtedly true, as argued by Mr. Beverley, "that water, *if unobstructed*, will find its own level;" but by following out the practical application of this "simple law," we shall see how it militates against the proposition of Mr. Beverley—viz., "that the water entering at the point A, forces the water over the curve at B, and thus the water flows freely, whilst the curve of the pipe being always full to the level of the *point of effluxion*, prevents the bad air passing up the pipe.

This, however, is not what takes place on all occasions. Upon emptying a pailful of water into the kitchen sink, the water passes down into the pipe C, which being filled becomes the longer leg of a syphon, which will continue to run until all the water is drawn out of the curved pipe, and gets below the bend, *b*, when air freely enters the pipe; a small quantity of water will remain somewhere about the line, *d*, *e*, (fig 1,) which may,

Fig. 2. Fig. 1.



or may not happen to seal the passage; upon most occasions it will not do so. This unfortunate result is not peculiar to Mr. Phillips' arrangement, but is an inseparable consequence of a *syphon trap*, of which this is only one modification. In the ordinary bell-trap, so long and so extensively employed, the same thing happens; the descending-pipe, C, fig. 2, being the larger leg of a syphon, draws off all the water until the air reaches the level, *d*, *e*, and then, *good-by*, *trap!*

This is the reason why in so many houses bad smells continually arise from the sink, in spite (as is supposed) of the most careful trapping.

If the water merely *flowed through* the trap by its own gravity, it would only fall, as Mr. Beverley has supposed, to the lines A, B; but being *forcibly drawn through* by the preponderating column, C, it falls to the line, *d*, *e*, or below it, and vitiates the joint. In many sink-holes the water is drawn through with so much energy as to cause the air, in following it, to produce a loud sucking sound.

As this subject is one of considerable moment, I trust the gentlemen whose names I have quoted will pardon these remarks, and beg to remain, theirs and yours,

Very respectfully,
Wm. Baddeley.

29, Alfred-street, Islington,
Feb. 21, 1849.

Sir,—It is with a very fair spirit of inquiry that your correspondent, "A. Z.," takes up the subject of Davies's rotary engine; his remarks are forcible, and evidently made by a practical man. I regret that, instead of drawing his conclusions from a published account of the engine, he has not had an opportunity of seeing it at work. If he had, I feel confident his opinion would have been greatly modified, if not entirely changed.

I ask your permission to make a few remarks in reply to "A. Z.," and will observe upon the objections contained in his letter categorically.

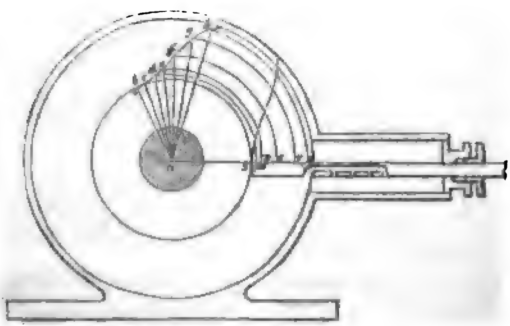
The first point "A. Z." alludes to, is the metallic packing, of which he very justly approves. I will, before concluding this paper, take an opportunity of offering some observations in reference to it. "A. Z." next observes—

"One of the chief objects proposed for attainment in rotary engines is, to avoid the loss of power and limitation of speed, incident to reciprocating engines, from the *vis inertia* of the moving parts, which must be overcome at each reversal of the motion of the piston. But to attain this advantage, it is not sufficient that the piston has a direct rotary movement—there should be no reciprocating movement in any part of the machine. Now in Davies's, the steam stop or abutment has to be moved rapidly out and in at each revolution, and, as it moves under pressure, the friction must be considerable."

Most assuredly the direct rotary action of the piston dispenses with many of the reciprocating parts of the ordinary engine—the use of the piston-rod, beam, connecting-rod, &c., is altogether obviated; and the only reciprocating part of Davies's engine is, in fact, the steam stop or abutment, to which "A. Z." alludes, and which may be compared to the steam slide of an ordinary engine. If, therefore, reciprocating motion be one of the principal objections to the ordinary engine, that objection is here almost entirely overcome; for the revolving piston is substituted for all the heavy moving parts; the slide, or stop, which weighs but a few pounds, only remains.

The objection to a reciprocating motion is, of course, the amount of passive resistance, inherent in bodies, which opposes a change of state, either from motion to rest or *vice versâ*. This force is always directly as the mass moved multiplied by the square of the velocity, abstracted, or imparted; hence it follows, that in order to prevent undue resistance, the motion should be given very gradually, and slowly increased until it becomes a maximum, from which to avoid impact, or the shock consequent upon a sudden stoppage, it should decrease equally slowly until the motion is exhausted. This, in the reciprocating engine, is certainly most beautifully effected by the crank; and in Davies's engine the motion is imparted to the stop, no less beautifully, by the cams, which are, in fact, constructed on the principle of the crank, as may be seen by the diagrams published with the specification.

The following sketch will show the motion of the stop:—



From the centre, *a*, draw the radial lines *ab*, *ac*, *ad*, &c., intersecting the piston at the points, *b*, *c*, *d*, &c.; and from the centre, *a*, with the radii *ab*, *ac*, *ad*, &c., describe the arcs, *bz*, *cy*, *dx*, &c.; then, whilst the piston is revolving through the arc subtended by the radial lines, *ab*, *ac*, &c., the stop will have receded through the horizontal spaces, *zy*, *yx*, &c., and since the piston revolves through the equal spaces, *bc*, *cd*, &c., in equal times, the spaces, *zy*, *yx*., &c., show the gradual increase of speed until it reaches a maximum, and the gradual decrease till it stops and is at rest.

Now when the piston is making 70 revolutions, or travelling at the velocity of 375 feet per minute, the space the slide moves through in the same time is 40·8 feet per minute, but as it is moving only about one-third of the time, the average velocity of the stop whilst in motion is 122·4 feet per minute. The *vis viva* of any body is, as before observed, compounded of the mass and square of the velocity, and as it is this that is operating objectionably in a reciprocating action, we shall, by comparing it with the reciprocating parts of a beam engine of similar power, be able to form some idea of the amount of force avoided.

The weight of the stop in Davies's engine is about 40 lbs., moving at a medium rate of 122·4 feet per minute, or 2·03 per second; the *vis viva* is therefore $=\frac{40}{64}\cdot 2\cdot 03^2=2\cdot 57$. The weight of the reciprocating parts of a beam engine of similar power would probably be about 3000 lbs., which having a motion of about 5 feet per second gives a *vis viva*, or an opposing force to any change of motion of $\frac{3000}{64}\cdot 5^2=1172$. Do not let me be misunderstood; I do not mean to say that power is lost at every stroke of the engine to this extent—the action of the crank prevents that; if force be suddenly checked, there is impact, which would be sensibly felt by the shaking of the engine, and which would eventually tend to its destruction. Doubtless, power is lost by reciprocating motion, and whether that is little or much, the above calculation shows the comparison, in this respect, between the ordinary engine and that of Davies'.

"A. Z." is wrong when he observes that the slide "moves under pressure"—it does not, for directly it begins to recede within the box, a communication is opened between the upper and under side of the stop, when the steam is in equilibrium on both sides of the piston, and the only friction that exists in the movement of the stop is that caused by its own weight; this is the theory of the motion of the stop. I have examined one, after it had been in use upwards of two years, and therefore can speak confidently on the subject. It wears as well as an equally well-constructed slide of a reciprocating engine."

"A. Z." proceeds: "Another principal object is to obtain a direct rotary action without the assistance of a fly-wheel, and the power of starting the engine in every position of the piston; but in Davies's engine (that is to say with a single cylinder) when the piston is directly under the sliding abutment, the steam has no power to turn the piston in either direction, and a fly-wheel is required to carry the piston past that point. It is true that by employing a second cylinder, with a piston set at an angle with the piston of the first cylinder, the fly-wheel may be dispensed with, but the same is the case in reciprocating engines."

A fly-wheel is not a necessary appendage of Davies's engine; it is true there is one, and a heavy one, too, at Messrs. Edelsten and Williams's; but this is rendered necessary by the work the engine has to perform. "A. Z." will understand this when I tell him that the work required for the lever shaft which is taken directly from the engine is constantly varying. During one instant as much as five horses' power is employed, and in the next perhaps, the work of two horses may be thrown out; this irregularity it is necessary to provide against, and hence the fly-wheel.

Davies's engine has no dead point, because there are *always* two pistons on the same shaft. This, I suppose, is a feature of the engine which "A. Z." would object to; but the utility and efficiency of the arrangement are unquestionable.

As regards the extra expense consequent upon having two pistons instead of one:—In the engine at Edelsten and Williams's, there is not 2 cwt. of metal more than there would have been had one cylinder of double the power been

used; the extra expense is, therefore, very trifling.

"A. Z." seems to forget, when he alludes to "another class of rotary engines, in which a cylinder placed eccentrically within another cylinder, so as to be in contact with the same at one point, is caused to revolve by the pressure of the steam upon one or more rectangular pistons alternately projected from and forced into the interior cylinder," that the alternate projecting and forcing into the cylinder is essentially a reciprocating motion; and in the class of engines here alluded to, the motion of the piston is a compound motion made up of the revolution of the eccentric cylinder and the reciprocating motion of the rectangular pistons. This is one point in which I consider Davies's engine very superior; for he separates these motions, and gives the reciprocating motion only to be borne by the stop. The piston merely revolving, each part has, therefore, to perform its respective function; but in the class of engines "A. Z." speaks of, the rectangular piston has to traverse a path combined of the two motions; and the failures (I think I may say) of all attempts to accomplish this, will show the almost impossibility of overcoming the difficulty. "As regards the economy of space:"—Davies's engine, *without the fly-wheel*, at Messrs. Edelsten and Williams's (which is equal to about 13 horses power), occupies a space of 5 feet 4 inches long by 4 feet 4 inches broad, and 2 feet 4 ins. high; a box of 57·024 cubic feet would, therefore, be sufficient to hold it.

I have no wish to make any invidious remarks in reference to the engines which "A. Z." says are at work, in saying that, except Davies's, I have never seen a rotary engine work to my satisfaction. Perhaps I have not seen those particular engines to which "A. Z." refers.

It was my intention to have made some remarks in reference to the metallic packing; but, as this letter is already longer than was at first anticipated, I must defer these to another opportunity.

I am, Sir, yours, &c.,

WILLIAM DREDGE.

London, 10, Norfolk-street, Strand,
March 5, 1849.

MESSRS. WEST AND THOMPSON'S PATENT CLASP COUPLING JOINTS.

(Patent dated March 22, 1848. Specification enrolled September 22, 1848.)

The inventors of these coupling joints are American engineers,* on whose behalf they were patented and specified in this country, of the dates above stated. We understand that they have already come into general use in the United States, and we make no doubt of their being also extensively adopted here—for they have the merit of being at once extremely simple and of manifest efficiency.

Specification.

Figs. 1, 2, 3, and 4 represent in elevation, plan, vertical section, and perspective views, one of the improved clasp couplings, as applied to the coupling of pipes. Figs. 5, 6, and 7 are elevation, plan, and vertical section of the invention, as applied to the securing of a cap-plate on to a quadrangular vessel; and figs. 8, 9, and 10 are elevation, vertical section, and plan representing a modification of the invention, as applied to the coupling of small pipes. In all the figures, corresponding parts are indicated by similar letters.

The principle or character of the invention consists in forcing together the two bodies to be coupled or connected, by means of a grooved, segmental, or other clamp, according to the form of the parts of the vessel or article to be coupled; the groove of the coupling embraces the flanges or their equivalents, which project from, or are connected with, the bodies to be coupled, so that when the said grooved segments are drawn together by screw bolts, keys, conical wedge rings, or any equivalent means, the groove therein shall act on the said flanges, or their equivalents, so as to force them together, and thus make a tight joint with or without interposed packing.

In figs. 1, 2, 3, and 4, *aa* represent two sections of a steam or other pipe, each provided with a turned or upset flange, *b*, with packing, *c*, of any kind interposed; but if desired, the packing can be dispensed with by facing the flanges, or making what is termed a ground joint. At the junction of the two pipes, an inner pipe or sleeve, *d*, is introduced within the pipe, to serve as a guide in joining the flanges together; but this may be dispensed with if desired. Over the two sections of the pipe, and extending over the flanges, are

* London agents Mr. Clinton Charles Gilroy, and Messrs. Grissell and Co., Regent's Canal Iron Works.

two rings, one for each section, the inner faces of which correspond, or nearly so, with the faces of the two flanges, and have their outer faces curved or bevelled. These rings should be made to fit somewhat closely on to the section of pipe, or may be shrunk on if desired. When the two flanges and rings are put together, face to face, they are embraced by a segmental clamp, *f f*, made in two parts, the inner periphery of which is grooved to embrace the rings, *ee*, and to act on the outer curved or bevelled faces thereof, so that when the said segments are drawn together by means of screw-bolts, *gg*, that pass through ears, *h*, *h*, *h*, *h*, which project from their ends, the sides of the groove are

Fig. 8.

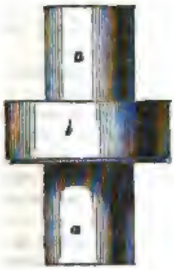


Fig. 3.

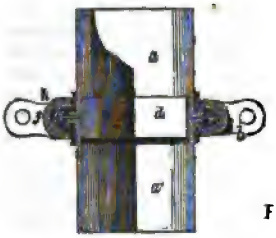


Fig. 1.

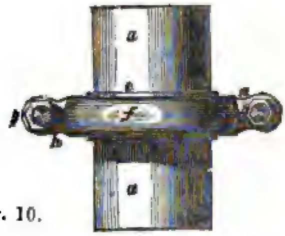


Fig. 10.

Fig. 9.

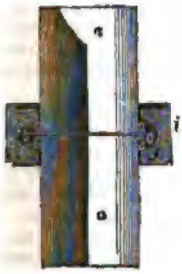


Fig. 4.

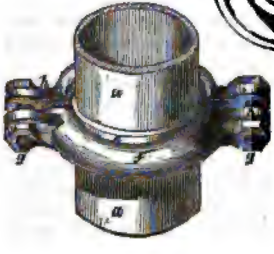


Fig. 2.

Fig. 6.

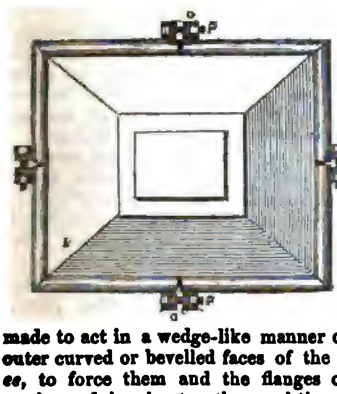


Fig. 5.

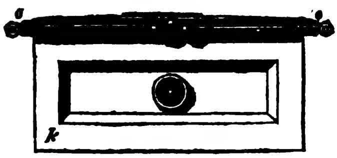
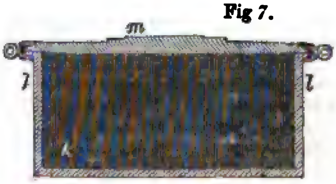


Fig 7.



made to act in a wedge-like manner on the outer curved or bevelled faces of the rings, *ee*, to force them and the flanges of the sections of the pipe together, and there hold them firmly. In this way it will be seen that the flanges are forced and held together around the entire circumference by the use simply of two bolts, thus effecting a better joint, which can be connected and disconnected in less time, and held with more strength, than by the means heretofore employed.

Instead of forcing together the segments of the clamps by means of screw-bolts, as

above described, this can be done by means of a ring, *i*, as represented in figs. 8, 9, and 10, the inner periphery of which is made conical, so that it may be driven into the segmental clamp, the outer periphery of which is made of a corresponding conical form. In these figures the parts corresponding with those represented in the figures above described, are indicated by similar letters. The conical clamping ring for forcing together the segments of the clamp ring as a substitute for the clamp screws, have been tried for coupling small water and gas pipes, and have been found to answer the purpose; but this modification will also be found to answer for coupling large pipes and other articles. Instead of the clamp-screw bolts or conical rings, keys or other modes of drawing or forcing together the segments of the grooved clamp may be substituted.

The rings, *ee*, that extend over the flanges may be dispensed with, and the grooved, segmental, or other clamp may be made to act directly on the flanges; but it is better to use the rings, as they can be more readily adapted to the groove of the segmental clamp, and at the same time give strength and support to the flanges, which, in general, are formed by turning over and upsetting the metal of the pipe.

If desired, packing of any kind may be interposed between the flanges and the rings; but this in general will not be found necessary. Care should be taken to leave the groove in the segmental clamp, of greater depth than the projection of the flanges and rings, to give ample room for drawing together the segments; and care should also be taken to have the curve or bevel of the outer face of the rings, or of the flanges when rings are not used, of greater or less curve or bevel than the groove of the segmental clamp, so that in forcing them together, the segments of the groove may act in the manner of a double wedge to force together the rings or flanges; and the inventors prefer to make the curve or bevel of the groove more acute than the faces of the rings or flanges, so that in wedging them on, the sides of the groove may act on the rings or flanges nearer to the periphery of the pipe than would be the case if this state of things were reversed.

The improved coupling is equally applicable to the coupling of the parts of angular articles; and an example of this is given in figs. 5, 6 and 7 of the accompanying engravings, which represent a mode of attaching or coupling the cap into a quadrangular vessel. In these figures the upper edge of the vessel *k*, is provided with a projecting flange, *l*, with the under face rounded or bevelled, and the upper edge of the cap-plate, *m*, is similarly rounded or bevelled, to correspond therewith, and these, when put together, either with a close fitting (ground) joint, or with packing interposed, receive the grooved clamp *n*, which is made in four parts, each part fitted to one of the angles of the vessel, and these sections, which are provided with projecting ears, *o o*, are then drawn together by means of a screw-bolt, *p*, and thus couple and bend together the vessel and its cap, making a tight joint all round. Instead of uniting the sections at the four faces of the square they may be united at the angles.

It will be clearly seen from this example, that this improved coupling is applicable to vessels and other articles of angular or curved forms, and that whatever may be the form, any desired and effective mode of drawing or forcing together the segments of the ground clamp may be substituted for screw bolts or the conical rings.

In coupling angular vessels, or other articles, it will be found to be advantageous to make the grooved clamp in as many sections as there are sides to the figure, and for round couplings it will be found sufficient to make it in two parts for all articles of moderate size; but when the diameter is very considerable, it may be divided into three or more parts.

This improved mode of coupling is equally applicable to the securing of nozzles, stop-cocks, bonnets, and many other articles not necessary to enumerate, and particularly to cylinder heads, in which the edge of the head takes the place of one of the flanges.

It will be evident to any engineer or machinist, from the foregoing, that shafts and other solid bodies can be coupled together in the same manner as hollow conduits or vessels, and with equal advantage, and by a similar arrangement of parts, and therefore it is deemed unnecessary to give an example.

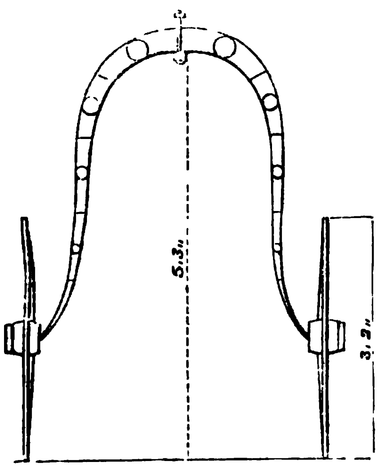
The flanges, instead of solid projections of the bodies to be united, may be made separate, and connected therewith in any manner desired, as the mode of making the flanges forms no part of the invention.

The leading advantages of this mode of coupling over the ordinary double flange and bolts, heretofore and now generally used, are a great reduction in the number of screw bolts used, which occupy much time in connecting and disconnecting joints, particularly in the parts of steam engines, such as cylinder heads, and other parts, which require to be frequently connected and disconnected for packing and other purposes, and increased strength and more perfect and continuous support, as the flanges, by the improved plan, instead of being reduced in strength by the numerous bolt-holes, are pressed together and supported all round by the grooved segmental clamp, and the strain on the threads of the screw-

bolts, instead of being in the line of the force which tends to separate the coupling, as in the old plan, is nearly at a right angle therewith, and therefore greatly relieved. There are other advantages which, however, it will be unnecessary to enumerate.

Having now described the invention, and the manner of constructing and using the same, and having stated the leading purposes to which it is applicable, together with the various modes in which the invention may be applied, as it has been communicated to me by my foreign correspondents, I would observe, in conclusion, that I do not mean to limit myself to the precise arrangement or mode of constructing the parts, as herein shown and described, as it will be evident that the mode of carrying out the principle admits of considerable changes and variations from the plans herein shown and described, without departing from the nature and object of the invention; but that which I consider to be new, is coupling joints by means of flanges or their equivalents, in combination with a grooved clamp, the groove of which is formed to embrace the flanges, and which clamp, when drawn or forced together by screw bolts, or other equivalent means, will force and hold together the flanges of the parts to be connected, and thereby form a firm and secure point.

BURBURY'S SAFETY CARRIAGE.



Sir,—The "safety carriage" described in your last Number, or at least one precisely similar, was invented by Mr. Addis Jackson, of Orpington, Kent, in 1846, and tried by me, at his request, in May, 1847. I send you a drawing of the *axletree*, which I made for the purpose of experiment. It may, perhaps, serve to convince Mr. Burbury, as it did myself, of the impracticability of the plan. The axletree was formed of two bars of iron, kept at a distance from each other by means of iron rings or bolts, so as to form a "truss." Notwithstanding the strength thus gained, the wheels could not be kept steady. The length of each of the bars composing the axletree was about 10 feet—that of the usual axletree is less than four feet. Apart from the difficulties of construction (of which I have mentioned only one), there is an error of principle, which is quite condemnatory of the plan. The front wheels are placed abreast of the fore legs of the horse, and the centre pin or perch-bolt is immediately above the wheels.

Now, as the centre upon which the body of the horse turns is much more backward, if not altogether behind him, it follows that he would have to *push* the wheels sideways in turning, thereby causing them to *scrape* on the ground. Mr. Jackson did not place his wheels so forward, and on that ground had a better chance of success, both on account of the reason last mentioned, and also because of the diminished length of the ironwork, &c., by which the fore axletree is connected with the hinder one and with the body of the carriage.

I am, Sir, yours, &c.,

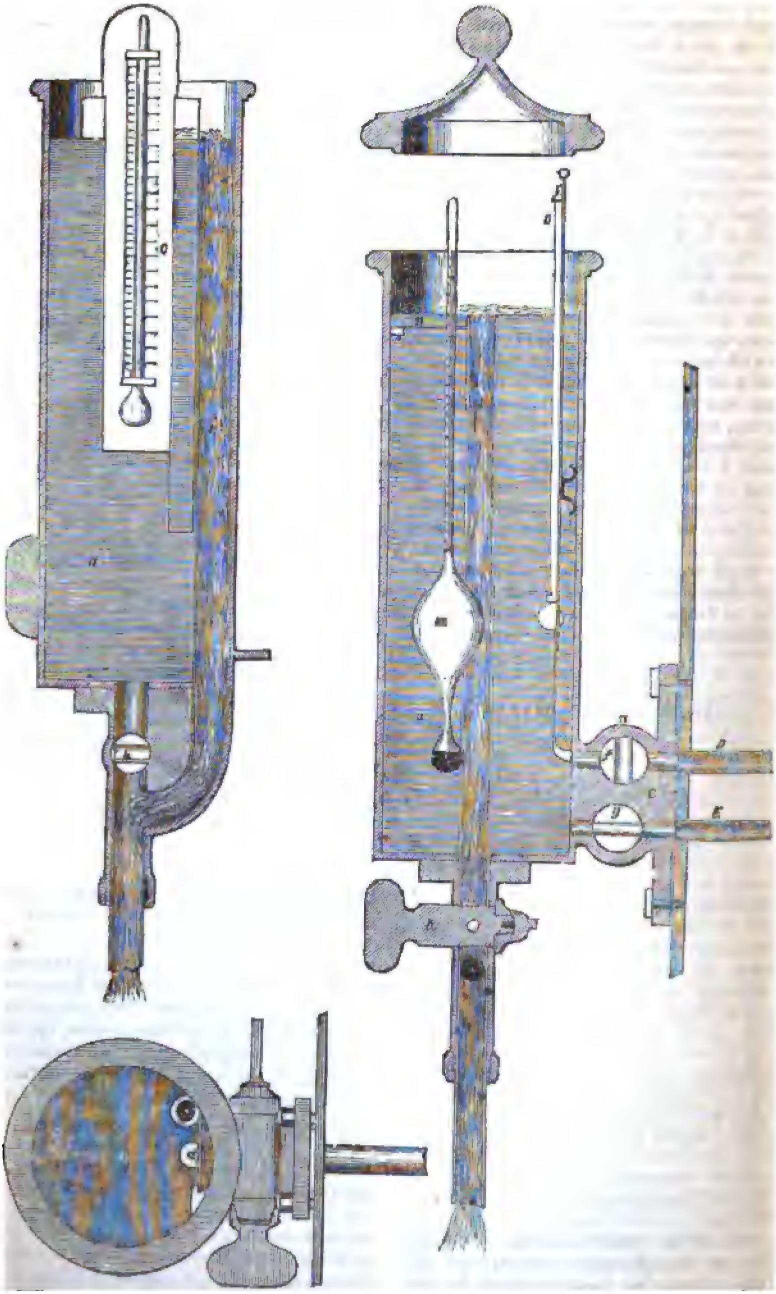
JAMES ROCK.

Hastings, Feb. 26, 1849.

DESCRIPTION OF AN IMPROVED SALOMETER, INVENTED BY MR. ANDREW P. HOW, ENGINEER, U. S. NAVY.

The office of this instrument is to obtain water from near the surface, or from near the bottom, or from any other part of the boilers of marine steam-engines, for the purpose of ascertaining at all times, by inspection, the exact degree of *saltness* of the water at those parts of the boiler.

The construction is as follows: A cylinder of brass or other metal, *a*, is affixed to the front or the other part of the boiler by means of screw-bolts in a suitable manner; for which purpose the cylinder has a projection, *c*, on one side. When attached it stands vertical and parallel to the front, as shown in the



engraving, or (which I rather prefer) it may be located in the engine-room, at a distance from the boilers, by having suitable pipes connecting to those leading to the interior of the boiler, as represented at D E. Two holes are made through the projection, *c*, which open a communication between the interior of the boiler and the interior of the cylinder. Within the boiler are two metal pipes, one attached to each opening through the projection, *c*; the upper one, D, passes upward and terminates near the surface of the water in the boiler; the lower one, E, passes downwards, and terminates near the bottom of the boilers. Within the projection, *c*, are fitted two stop-cocks, one to each opening as in the engraving. One of them, *f*, is represented closed, cutting off the communication with the upper pipe; the lower one, *g*, is kept open by which the cylinder communicates with the lower part of the boiler from which it is kept filled with water to a certain depth, which is regulated by the height of the overflow pipe, *i*, which carries off the surplus water. A current of water is thus kept constantly passing through the cylinder, which keeps it at the same degree of saltness as that part of the boiler from which it has been drawn. The stop-cock, *h*, is for the purpose of letting the water out of the cylinder, *a*, below which the overflow pipe joins and forms one pipe as shown in the figures.

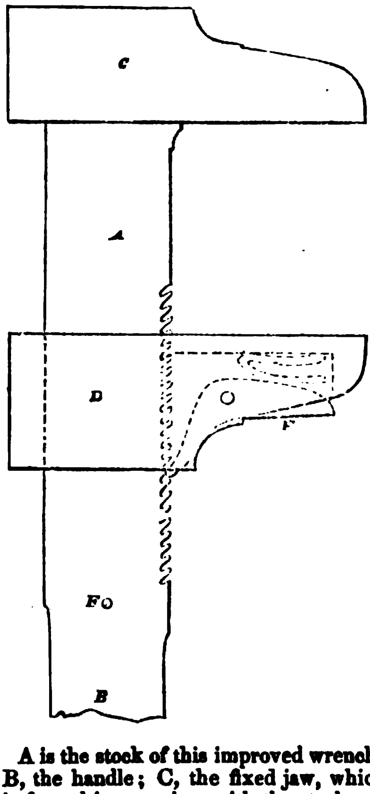
Within the cylinder I have an hydrometer, *m*, floating at a height corresponding to the density of the water, sustained and kept in place by a bracket, *n*. I also have a thermometer within the cylinder, to indicate the temperature of the water, and designated on the engraving by the letter *o*. By this means I am enabled to ascertain at all times, by inspection, the exact degree of density or saltness of the water in any desired part of the boiler.

If it is desired to know the saltness of the water at the surface, close the cock *g*, open the cock *h*, to empty the cylinder; then shut the latter, and open the cock *f*, when the cylinder will be filled with water from near the surface, and its saltness will be constantly indicated by the hydrometer referred to above.

The present apparatus is different from all others for a like purpose in this particular—that the water is relieved from the pressure of the steam within the boiler, and is only under atmospheric pressure, and, consequently, indicates constantly (no matter what the pressure or temperature in the boiler may be). All other instruments are subjected to the same pressure and temperature as the water in the boiler; and as the temperature of the water varies, so do the indications.

MESSRS. ASHFORTH AND CO.'S RATCHET WRENCH OR SPANNER.

[Registered under the Act for the Protection of Articles of Utility. Messrs. Joseph Ashforth and Co., of Bruce Works, Bridge-street, Sheffield, Proprietors.]



A is the stock of this improved wrench; B, the handle; C, the fixed jaw, which is forged in one piece with the stock and handle; D, the moveable jaw, which has a hollow recess cut out of the back for the reception of a ratchet or tumbler, E. One end of the ratchet takes into the serrated notches cut upon the inside of the stock, in which position it is securely

held by a spring inserted behind the ratchet, and within the recess formed in the jaw. By this arrangement the moveable jaw may be moved forward towards the fixed one, so as to suit any size of grip while the ratchet completely secures it from again sliding back, unless released for that purpose, by being pressed upon its free end, which overcomes the power of the spring and liberates the jaws. F is a pin, to prevent the moveable jaw from coming off the stock.

CONCLUDING REMARKS ON SERIES. BY PROFESSOR YOUNG, BELFAST.

Only one or two additional observations on this subject seem to be necessary for the guidance of the young analyst. It has already been noticed (p. 182) that, for any diverging series, "no expression whatever can be properly assigned for its sum;" and we thus see with what limitations the theorems of Newton, Taylor, Lagrange, and Laplace, must be received. None of these theorems have the generality usually attributed to them: they may be replaced by the functions, to which they are assumed to be equivalent, only when the terms spontaneously terminate, or tend to zero, requiring no supplementary correction or remainder; except, indeed, in those particular individual cases in which such remainder, when it generally exists, becomes evanescent. In certain other particular cases, the series itself will give notice of the impracticability of the supposed development, from the circumstance of the coefficients, assumed to be finite, manifestly becoming infinite: in such cases the theorems are acknowledged to *fail*, and we are thus precluded from error. But in other cases, no such indications of failure manifest themselves; and we are exposed to mistake when we conclude any thing, as to the relation between the function and its supposed development, previously to applying some test of convergency. From overlooking this, properties, which seem to have place for the development, have been found to fail for the function generating it, on account of the general corrections of the development having been disregarded. Some years ago, a discrepancy of this kind was detected, in a certain exponential function, by two very distinguished analysts, and which plainly falsified the supposed principle that "if an expression vanishes for $x=a$, it must be divisible by $x-a$," which is necessarily true whenever the expression is completely developed according to the powers of x, but not in any other case. Without going to transcendentals, ordinary algebraic forms would have furnished an abundance of examples of the inapplicability of this proposition, which is generally true of such forms only when they are rational. The simple function $(x-a)^{\frac{1}{n}}$, for instance, which vanishes when $x=a$, is not divisible by $x-a$: what quotient can be assigned to

$$\frac{\sqrt{x-a}}{x-a}\ ?$$

Certain exponential and trigonometrical functions conform to this principle; but, as we here see, those of common algebra resist it in a large class of cases. The division meant in the enunciation of the principle is, of course, the common algebraical division, giving a quotient which is rational, at least as respects x.

From these remarks the reader will perceive that, as *general* algebraical equivalents of the proposed functions, the celebrated theorems mentioned above are always inaccurate, inasmuch as they are always incomplete: the binomial theorem is true when the exponent is a positive whole number; but in every other case it has exceptions, and can be employed with accuracy only when the exponent and the terms of the binomial are so related to one another, as to render the series convergent, or the general correction of it evanescent; and if the steps of any general investigation of this theorem be examined, we shall always find that the reasoning proceeds on the assumption that this evanescence takes place. And, similar remarks, apply to the other theorems alluded to above.

I take this opportunity of mentioning, that upon very recently looking over the first number of the *Cambridge Mathematical Journal*, I found an article on "Elimination," by an anonymous writer, the same in principle as one by me at p. 424 of vol. xlvii. of this Magazine: there are some details in this latter article not in the former, which perhaps render its publication not entirely superfluous; but the views and objects of the former

writer were evidently the same as those which subsequently prevailed with me; and I take this, the first opportunity which has offered, of yielding to him the priority.

Belfast, Feb. 28, 1849.

MR. STENSON'S IMPROVEMENTS IN STEAM BOILERS.

Sir,—Having just read in your last Number a communication from Mr. Medworth respecting my patent boilers, which is accompanied with a copy of a letter I wrote to Mr. Stanley in July last, I feel called upon to offer a few remarks in answer thereto.

The experience which more than a quarter of a century has afforded me, has proved alike the necessity for greater economy and safety in steam engine boilers, and also the danger involved in the usual modes of constructing them—in consequence, chiefly, of the little regard paid to a due provision for a free and uninterrupted circulation of the water.

Some of the improvements described in my specification are calculated to ensure a better supply of water to such parts as are exposed to the greatest heat, and so to prevent the plates from being injured by undue expansion, as also to provide against other contingencies of much worse, because more dangerous, qualities.

It is well known to those engineers who have paid attention to the effects of excess of heat on boiler plates, that the original fibrous texture of the iron is frequently injured, and that its molecular arrangement gradually loses its fibrous structure and becomes granulated or crystaline, and that the strength of such plates is proportionately deteriorated.

But (in the absence of saline, calcareous, or other deposits) where the conditions of unobstructed circulation have been duly provided for, it is highly improbable—if not impossible—that any boiler can be injured by over heating. Mr. Medworth, however, seems either to have been ignorant as to the cause or existence of such injury to boilers, or incompetent to appreciate the value of a means for preventing similar occurrences.

As my letter to Mr. Stanley refers to Mr. Beale's boiler, I may here observe, that though I believe it to be of a good form for generating steam—an opinion which is verified by the result of a locomotive fitted with a Beale's patent boiler, and known as "Mr. Samuel's express engine, on the Eastern Counties Railway,"—yet I hold that the pipe, K, as in figure 23, to which Mr. Medworth alludes, would increases the economy of that boiler, and that a still greater economy would obtain, if fitted with the smoke-box for the purpose of drying the steam. A larger steam chamber, which such a mode of fitting would allow, and which seems desirable, would also be obtained.

With respect to the boiler, as in fig. 24, the outer shell is the only feature in which it bears any resemblance to the other; it is, however, also provided with a means for circulation; for, as the water ascends through the central tubes, a further supply to the auxiliary generator is ensured through the tube, *h*; and for preventing any excess of heat driving upwards the body of water out of the main water space, B′B′, I have provided an auxiliary supply pipe from the upper to the lower part of that water space.

Your Magazine, vol. xlix., page 470, contains a Report of the Franklin Institute on the explosion of an engine boiler. This report is ably drawn up by men of talent; and I have pleasure in referring your readers to a second perusal of it; and I think "they who run may read" that if the boiler there referred to had been supplied with a pipe, as shown on the outside of my boiler, fig. 24, the explosion would not have occurred. I may add, however, that the tubes with closed ends, suspended from the inner crown plate, indicate an amount of danger which no prudent man would risk.

The smoke duct over the steam-chamber of boiler, fig. 24, is, so far as I am aware, perfectly new; I do not ascribe to it any value in generating steam, or apply it for any other purpose, except that of carrying off, as part of the chimney, the gaseous residue of the carbonaceous or other unconsumed products of combustion. The sliding doors, however, afford a ready facility in cleaning the flues. The external make of Messrs. Barratt and Co.'s boiler, exhibited at York, was certainly not like mine; but as the whole of their boiler was concealed by sheet iron, and as "mine are only common eyes," I was unable to penetrate into the mysteries of its interior.

In conclusion, I wish Mr. Medworth clearly to understand, that I do not pretend any more than he could, to be the inventor of tubular boilers, but that I limit my claims to having added some valuable improvements and new combinations of parts, in the ultimate success of which I have the fullest confidence.

I am, Sir, yours, &c.,

JOSH. STENSON.

Vulcan Engine and Mill Works,
Northampton.

EXPERIMENTS WITH LIQUID MANURE DISTRIBUTORS.

[*From the Morning Chronicle.*]

On Wednesday last a number of gentlemen connected with the Metropolitan Sewage Manure Company, and their friends, assembled at the works, Stanley-bridge, Fulham, and proceeded from thence to a field in the immediate vicinity to witness certain experiments in irrigation.

The plan by which the company proposes, in the first instance, to supply the sewage manure of the metropolis, and Thames water, for the purposes of irrigation, is to drive a pipe in connection with their works through every acre of land, in the centre of which they would place one of Bateman's patent fire-cocks. This invention was exhibited, and is especially worthy of notice. It is available for all the numerous offices of stop-cocks generally, and from its suitability for high-pressure purposes, would appear to be peculiarly adapted as a substitute for the ordinary fire-plug. We hear that the purchasers of the patent (Messrs. Guest and Ghrimes, of Rotherham), have already contracted to supply Manchester and many other large towns with these improved cocks as substitutes for fire-plugs. The great peculiarity of the invention is that the valve consists of a round ball of wood covered with India-rubber, which hermetically seals the orifice when the water is turned on at high-pressure, and on being forced down by a screw regulates the supply from the smallest dribble to the most impetuous torrent. To this valve boss—as the patentee calls it—is attached an upright pillar with arms, and an instrument very much in the shape of a common fire-shovel, which Mr. Warner has registered under the title of a "distributor."

The first experiment tried was with a supply of water from the fire-cock—high-pressure having been put on at the station. The water was passed through hose with a distributor attached, and was spread over a breadth of sixteen feet by two men. This is called the Manchester plan, but it seems open to many objections. The hose drags on the land, and the waste of power and increase of manual labour would prevent its being generally adopted with advantage.

Mr. Coode's patent irrigator* was next tried, by a large model about two-thirds the full size. Its construction is extremely simple, consisting essentially of a long conical cylinder of from 7 to 10 yards in length, on wheels, and easily removed at a walking pace by a stout lad. This tube is perforated, and delivers liquid through its whole length. As it moves along, the hose by which the cylinder is fed, by an ingenious contrivance, is continuously supplying the implement with as much liquid as it can distribute. The implement delivers the liquid with perfect equality, without violence; a great advantage when strong liquid manures are used, or seeds and feeble plants are to be watered or manured. The required water power for working it might be procured from a common pump, and is such that every farmer or gardener might command. At the end of every 36 yards, the implement has to be coupled afresh to the main hose by which it is supplied. The arrangements for doing this were evidently defective, but the principle was very apparent. By means of this implement, from 14,000 to 20,000 square yards may be irrigated within the hour.

Next came the experiments from the fire-cock and distributor. The water being turned on at high pressure, the distributor irrigated, like a fertilising shower of rain, a circle of about 80 feet in diameter. Hose were then screwed to the pillar, and conveyed a distance of 80 yards, and attached to a moveable tripod, constructed for the purpose, from whence the process of irrigation was repeated. By means of these moveable tripods an acre of land may be constantly watered and irrigated from one stationary cock, with a moderate length of hose. It is calculated that one man might move the pipes, valves, &c., and irrigate one acre of ground within the hour. This is the plan sanctioned by the company.

The experiments were watched with deep interest, and appeared to give great satisfaction.

* For a full description of this invention, see *Mech. Mag.*, vol. xlvii., p. 269.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING FRIDAY, MARCH 9.

WILLIAM EDWARD HOLLANDS, Regent's Quadrant, Middlesex, dentist, and NICHOLAS WHITAKER GREEN, Walton-place, Chelsea. *For a new manufacture of artificial fuel in blocks or lumps.* Patent dated September 4, 1848.

For specification and claims, see *ante*, p. 67.

JOHN LEWIS RICARDO, Lowndes-square, Middlesex, Esq., M.P. *For improvements in electric telegraphs, and in apparatus connected therewith.* Patent dated September 4, 1848.

These improvements refer—

1. To a mode of insulating wires used for electro-telegraphic purposes; and, 2. To an apparatus for suspending them.

The wires are led, from a reel, between a pair of rollers heated by steam or hot water, which are furnished with grooves on their peripheries, exceeding by two the number of wires to be insulated. The rollers are placed at such a distance apart as that the edges of the grooves shall not come into contact. Two fillets of gutta percha, or of any compound containing that material, are passed between the rollers, above and below the range of wires, whereby they are pressed closely together, so as to insulate the wires from external substances. The wires are caused to pass through the centre of each groove, and the portions of the fillets between each wire are pressed together by the edges of the grooves, so as to insulate the wires from each other. The surfaces of the fillets intended to be brought into contact, are rendered adhesive by being made to pass over heated metal surfaces previous to their entry between the rollers. The under fillet may be supported in any suitable manner to prevent it from breaking or stretching after being heated.

The apparatus for supporting the wires is composed of earthenware, or any other non-conducting substance, having a hollow centre, closed at top by cement, in which the hook is suspended so as not to touch the sides of the apparatus. A "throat" is constructed on the under surface of the apparatus, which has the effect of preventing the passage of water from the exterior surface to the hollow centre of the apparatus.

Claims.—The mode of combining two or more wires used for electric telegraph purposes with gutta percha, or any compound containing that material, so as to insulate one wire from the other or others, and from external substances.

2. The apparatus for suspending wire used for electric telegraph purposes.

[We see nothing in Mr. Ricardo's modes of insulating electric telegraph wires, essentially different from those previously patented by Mr. Reed and Mr. C. Hancock. See vol. xlvii., p. 160, vol. xlviii., p. 516.

Richard Laming, Clichy-la-Garonne, Paris, France, chemist. *For improvements in the modes of obtaining or manufacturing sulphur and sulphuric acid.*

This patent being opposed at the Great Seal, bears date 4th September, 1848, although not actually sealed until the 13th January, 1849, the former being the day when it would have been sealed had no opposition been entered. [By order of the Lord Chancellor.]

1. The patentee employs pumice-stone, or other cheap porous substance, the catalytic energy of which is increased by boiling in concentrated sulphuric acid, which is afterwards strained off. It is then immersed in water containing about 20 per cent. of ammonia, dried, and finally placed in a retort, along with about one per cent. of peroxide of manganese, in which it is elevated to a temperature of 600 degrees Fahr., when it is allowed to cool without atmospheric air being admitted to it. Or, the pumice-stone may be boiled in sulphuric acid, and immersed in nitric acid, or other alkaline nitrate. Or it may be boiled or simply immersed in a mixture of sulphuric and nitric acids.

2. The catalytic substance is placed in the three uppermost compartments of a vertical cylinder, which are formed by three sliding registers. The upper compartment is closed at top by a moveable cover, and separated from the second compartment by the first register, while the second register is perforated to allow of free communication between the second and third compartments. The lower or fourth compartment is separated from the third one by the third register, and is left empty. The third compartment has a portion of its lower circumference perforated and inclosed in a jacket, into which the induction pipe from the sulphur furnace is inserted. The sulphurous acid gas, as evolved from the furnace, together with the necessary quantity of atmospheric air and a small quantity of ammoniacal gas (in the proportion of 1 to 1000 parts of sulphuric acid produced during the same time) enters the jacket, and, passing through the perforations in the sides of the third compartment, ascends amongst the catalytic substances contained therein, up through the perforated second register and the catalytic substances contained in the second compartment, and finally passes out through the eduction pipe affixed thereto into the condensing apparatus. When it becomes necessary to renew the catalytic substances, the third register is drawn out, and the charge in the third compartment falls into the fourth. The other registers are successively drawn out, whereby each charge descends to the next succeeding compartment. The registers are then restored to their first positions, the top compartment filled with a fresh charge of the catalytic substance, and the lower one emptied of the vitiated substance. The part of the cylinder which forms the main conduit is heated to about 550 or 600 degrees Fahr.

The preceding arrangement prevents the necessity of staying the process to change the charge, and also the entry of atmospheric air during such change, and effects, as it is stated, a great economy in time, and space, and first cost.

The condensing apparatus consists of a

series of stoneware, vertical columns, which are open at bottom, and supported in hydraulic joints above the surface of the water in a cistern. These columns are hollow, and constructed in portions, with a number of horizontal ledges inside, having pieces broken away from each, so as to allow of free communication between the top and bottom of each column. The portions are connected by hydraulic joints, and the columns connected in pairs by curved pipes, around which water is caused to flow from any source of supply, so as to form hydraulic joints. The ledges in the columns support the catalytic substances, and serve to retain the water as it overflows from the hydraulic joints in the top of the columns.

The cistern is divided, longitudinally and crossways, by partitions, in order to cause the gas to pass up and down each column successively. The sulphurous acid gas is made to pass from the eduction pipe into the top of the first column, and down it along the surface of the water until it is intercepted by the first cross partition, and then passes up the second column into the top of the third, and so on, until it reaches the last in the first series, when it is intercepted by the longitudinal partition, and forced through the second series. Whatever uncondensed gas may remain, is caused to pass into a leaden chamber, which opens into a chimney sufficiently powerful to create the necessary draught throughout the whole of the apparatus. The solution is proportionally weaker, as the division of the cistern in which it is contained is farther from the first column, but increases in strength as it overflows each division successively until it reaches the first, whence it passes through a cock into the concentrating apparatus. It is stated that an apparatus of this description, containing 44 columns, 2 feet in diameter and 10 feet high, is capable of producing daily 20 cwts of sulphuric acid from 7½ cwts of sulphur.

3. The concentrating apparatus consists of a stoneware cylinder, in which are placed a number of diaphragms having holes in the centre of each. A number of tables of smaller diameter than that of the cylinder are supported one above the hole in each diaphragm. The tables and diaphragms are furnished with ridges of about an inch high. The sulphuric acid flows from the condensing machine through a syphon funnel on to the first table, whence it overflows into the diaphragm underneath, and so on throughout the entire series till it reaches the bottom of the cylinder, from which it passes through a syphon tube into a close vessel or other suitable receptacle.

In the bottom of the cylinder is a tube which passes up above the level of the sulphuric acid, and is protected by a hemispherical shield from the falling fluid, and conducts a current of heated air against the tables and diaphragms of the apparatus. The air and vapour generated, escape through an opening in the top into the first column of the condensing series, in which case it should be constructed of lead to be able to support the heat. Or, the products of combustion may be substituted for the current of heated air, in which case they cannot conveniently be made to enter the condensing apparatus.

Or, instead of the preceding methods, the eduction pipe may be closed, and the apparatus heated from the outside by any convenient means. Or, the sulphuric acid may be made to flow through a series of tubes heated by any convenient means.

When it is intended to adapt this invention to the manufacture of sulphuric acid by means of nitric acid, an apparatus, similarly constructed to that employed in the concentrating process, is substituted for the cylindrical magazine, with such other modifications as may be necessary.

4. The patentee remarks that it has been before proposed to employ as a source of sulphur in the manufacture of sulphuric acid that which results from the combustion of the sulphuretted hydrogen gas, which is evolved, together with carbonic acid gas, in treating the ammoniacal liquor of gas works with a mineral acid for the production of muriate of ammonia. But that this suggestion has never been found practicable in consequence of the incombustible nature of the carbonic acid gas, with which the sulphuretted hydrogen gas is combined. He therefore proposes to recover the sulphur in a solid state, by mixing the ammoniacal liquor with the mineral acid in a close wooden vessel, and receiving the sulphuretted hydrogen and carbonic acid gases thereby generated, in a close wooden vessel containing sulphurous acid, which last two reagents act upon each other with the formation of sulphur in the liquid, which may be run out with it, and allowed to precipitate. In order to recover such sulphurous acid as may escape with the carbonic acid gas, they are made to pass through several layers of sawdust kept constantly damp.

Claims.—1. The use of pumice stone or other cheap porous substance in conjunction with ammonia—the catalytic energy of which is increased by the mode or modes before described—in the manufacture of sulphuric acid.

2. The arrangement of apparatus, whether applied to the purposes of this invention or to the manufacture of sulphuric acid in the ordinary manner.

3. As regards the concentrating apparatus passing the sulphuric acid in slender streams, or a thin stratum having a progressive motion over heated surfaces, which increase in temperature as the acid becomes more concentrated.

4. The combination of the steps employed in the recovery of sulphur.

HENRY SMITH, Vulcan Works, West Bromwich. *For improvements in the manufacture of railway wheels.* Patent dated September 5, 1848.

This invention consists in forging railway wheels out of wrought, scrap, or piled iron, by means of a series of anvils and hammers, having the necessary shaped working faces. The wheel is heated and forged into the form of a disc, and has a hole turned in the centre by a lathe. Or, the iron may be forged by suitably formed tools into naves, having portions of the spokes made at the same time, and to which the remaining portions of the spokes, having the felloe attached, are welded in the ordinary manner.

Claim.—The mode of forming railways out of wrought iron by dies or anvils and hammers having working faces.

[For processes precisely similar, or nearly so, see the different railway-wheel specifications given in our last vol., pp. 386—392.]

GEORGE NASMYTH, Ebury-street, Pimlico, C.E. *For certain improvements in the construction of fire-proof flooring and roofing, which improvements are also applicable to the construction of viaducts, aqueducts, and culverts.* Patent dated September 7, 1848.

These improvements in floors and roofs consist in constructing them of iron plates, which are bent into the form of a segment of a circle, or into a conical, polygonal, or other shape, by the ordinary plate-bending machinery, or by any other suitable means. These bent plates are supported on chord plates, or tension bars, which have their ends bent upwards, whereby the plates are retained in their curved position when subjected to pressure. The ends of the chords rest upon the flanges of cast or wrought iron girders, above which are cast or riveted knee pieces, which prevent the bent ends of the chords from springing: or, instead of iron plates, angle or T iron, bent into the required shape, and supported upon chords resting upon the flanges of girders, may be employed. Over these curved ribs, iron plates are bent, with their ends placed underneath the bent-up ends of the chords. The spaces above the iron plates are filled up, to form the flooring, with Portland cement mixed with broken bricks and other suitable materials.

The improved girders are formed by bolting iron plates to the sides and top of stone arches and chords, combined as before. The side plates are made with flanges to support the arches and chords, which form the joists, and have also knee pieces bolted to them to prevent the chords from springing when the arch is subjected to pressure. The arches and chords may be made of one piece each, or may be made of several pieces bolted or riveted together. Currents of air may be caused to pass in the hollow spaces left between the arches and their chords, and through perforations in the floor in the room.

Claims.—1. The modes of constructing floors and roofs of buildings, and the beams or girders of bridges, viaducts, and aqueducts by means of metal arches, or other curved or angular figures, or both, which are supported by chords that serve as abutments to the arches.

2. The application of this flooring to the warming, cooling, and ventilating of buildings, by causing currents of air to pass through the hollow spaces left between the arched plates and the chord plates.

WILLIAM WHELDON, engineer to Messrs. John Warner and Sons, Jewin Crescent, brass founders and engineers. *For improvements in pumps, or machinery for raising or forcing fluids.*

The patentee shows in the drawing which accompanies his specification various modes of applying his invention, which we could not describe intelligibly without reference to diagrams. The principle on which they are all based will, however, be easily gathered from his Claim, which is for supporting the axes of the lever handles of pumps in the upper part of vibratory or rocking standards, which have their axes of motion below the axes of motion of the lever handles of pumps.

WILLIAM LOSH, Newcastle-upon-Tyne. *For improvements in steam engines.* Patent dated September 4, 1848.

Specification due, but not enrolled.

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal.*]

FOR AN IMPROVEMENT IN ROTARY PRINTING PRESSES. *Richard M. Hoe.*

Claim.—*First.* Putting the form or forms of type on a moveable or permanent segment of a cylinder, which forms the bed and chase, when this is combined with a cylindrical distributing table which occupies another segment of the same cylinder, substantially as described.

Second. Giving to the inking rollers a movement towards and from the centre of the cylinder that carries the form of types, when this is combined with the form of types and the distributing table, made on

one and the same cylinder, and of different radius, as described, whereby the inking rollers are adapted to the different diameters of the form of types and distributing table.

Third. Giving to the doctor or fountain roller of the inking apparatus, a slow continuous rotary motion in combination with the ratchet connection between the roller and the mechanism from which it receives its continuous rotary motion, whereby the ink is more regularly supplied, and by which also this supply may be altered when desired; and, lastly, the method of securing the form of types on a cylindrical surface with column rules made thicker towards their outer than their inner edge, by connecting these with grooves in the bed by which they are permitted to approach and recede from each other, and at the same time kept down to the same radius, whereby prismatic types can be secured and held on a cylindrical surface as effectually as on a flat surface.

For an Improvement in the Method of Giving the Reciprocating Rectilinear Motion to the Bed of the Napier Printing Press. *Richard M. Hoe.*

Claim.—The method of ending and commencing the alternating motions of rectilinear reciprocating movements, and insuring the proper relative positions of the cogs of the racks and wheel when the wheel begins to act on them, by means of the two racks and cog wheel, in combination with the vibrating lever.

The method of elevating and depressing the pressing cylinder, by means of the threaded sliding rods that carry the pressing cylinder, in combination with the cogged nuts and sliding bar, with a rack at each end, and so arranged that the racks and cogged pinions can be thrown out of gear for the adjustment of the cylinder, for the purpose and in the manner described.

For an Improvement in Re-acting Water Wheels. *Emanuel Parker.*

Claim. — Combining a wheel having buckets, with a circular tapering water way, or flue, inclined towards the periphery of the wheel, for the purpose of introducing the water to the buckets, at the required angle and quantity, and preventing the main body of the water resting on the wheel, the core being formed like the frustrum of a cone, and the inner side of the rim sloped or inclined outwardly, at the same angle as the sloped side of the cone, the periphery of said rim being vertical, and the top horizontal, and the buckets between them, the sections of a screw, whose upper ends are made to incline inwards on radial lines towards the core, at an angle of about 10°—the water-way, or flue, forming a segment of a circle, gradually lessening in depth from the place of entrance to where the end of the circle nearly intersects the place of beginning, the said flue inclining outward from a perpendicular line, about 20°, so as to pitch the water against the buckets at that angle, as above described and set forth, causing every bucket of the circle to be acted on simultaneously, the water escaping therefrom in a contrary direction to that at which the water enters, by which the pressure upon the pivot, which causes its rapid destruction, is removed, by which the mill is rendered more durable, as herein set forth.

For an Improvement in the Manufacture of Gas. *Benjamin F. Coston.*

Claim.—The employment of a retort, with the vertical branch containing the material for presenting heated surface to the rosin and tar or other substance to be gasified as it descends from the reservoir, as described, whereby the required surface is obtained to insure the production of gas with economy, and by which also the substance or substances from which the gases are to be produced, is compelled to pass over and around the heated surfaces.

2. Placing the reservoir or vase of crude material above the vertical branch of the retort, and combined with the stove or furnace, as described, and connecting the retort and vase by means of a pipe, which opens from one into the other, as described, by means of which arrangement the weight of the column of rosin and tar in the reservoir aids in forcing down the crude material into the vertical branch of the retort, to prevent choking, at the same time employing the heat of the furnace which surrounds the retort to keep the rosin, &c., in the reservoir in a liquid state.

Third. Combining the neck of the retort with the cooler, by extending this vessel (the cooler) entirely around the neck of the retort, and keep its temperature down to the boiling point, or below, and thus prevent the tar, &c., from baking in the neck of the retort.

Fourth. The method of regulating the supply of crude material to the retort by the consumption of gas, by combining the hood of the gasometer with the cock or valve of the supply pipe through which the crude material passes to the retort, in the manner substantially as described, whereby the cock or valve is opened by the descent, and closed by the rising of the hood. And,

Lastly. The method of condensing and washing the impurities from the gas, by combining with the gas pipe a condenser provided with a sieve for the spray of water, and the bent-up pipe for the discharge of the condensing water and impurities, without permitting the escape of the gas.

For an Improvement in Making Cigars. *Jonathan Ball.*

The patentee says,—"The nature of this invention consists in rendering the end of the cigar impervious to the moisture of the mouth, thus entirely preventing the ill effects of the tobacco to the lips, and at the same time preventing the ill effects of the moisture of the mouth to the cigar, without which it becomes saturated, and loathsome, preserving at the same time the draught or passage for the smoke perfectly free and open. The method I employ is to form a composition of gum shellac dissolved in alcohol, or any other substance that will dry quick, and is impervious to water."

Claim.—The application of the solution to the cigar, which renders it impervious to water or the moisture of the mouth while smoking.

For an Improvement in the Manner of Constructing, Propelling, and Turning Steam Ships. *Robert L. Stevens.*

Claims.—First. So forming a vessel as that the after part of the hull shall terminate in one or two cones, the after part of such cone, where it equals one-third or one-half of the whole diameter of the propelling wheel, more or less, constituting the central portion of a spiral propelling wheel, revolving with it, and being sustained and driven by a shaft extended forward through the axis of the stationary part of the cone.

Second. The turning a vessel round, either side, by passing a hollow tube through the hold of such vessel, towards either of her ends, by causing a current of water to pass through said tube, in either direction, by means of a spiral propeller, made to revolve within said tube.

FIRE-PROOF BUILDINGS.

An interesting paper on this subject by Mr. Braidwood, the Superintendent of the London Fire Establishment, was read last week at the Institution of Civil Engineers. The author analysed the evidence as to the capability exhibited by cast and wrought iron beams for sustaining weights where they were exposed to any extreme changes of temperature. He demonstrated, by a collection of specimens of metal from buildings that had been destroyed by fire, that occasionally the temperature in the conflagration of large buildings rose almost to the melting point of cast iron: and that even in a small fire, beams and columns of cast iron would be so affected by the heat and jets of water thrown upon them, that they would probably be destroyed, and sometimes cause a fearful loss of life; as in many of the so-called fire-proof warehouses of the city, a number of persons employed on the premises slept in the upper floors, and if the lower beams gave way, the whole would be dragged down suddenly—whereas timber beams resisted fire some time, and allowed time for the inmates to escape. Another point which the author considered had not been sufficiently insisted on was the derangement of the brickwork by the expansion of the iron beams at high temperature, and its sudden contraction on the application of cold water; and also from the mortar becoming completely pulverized by the excessive heat, instances of which have been known to occur. The following were the principles on which Mr. Fairbairn had proposed to construct fire-proof buildings. — The whole of the buildings to be composed of incombustible materials, such as iron, stone, or brick. 2. That every opening or crevice communicating with the external atmosphere be kept closed. 3. An isolated stone or iron staircase to be attached to every story, and to be furnished with a line of water pipes communicating with the mains in the street. 4. The different warehouses to be divided by strong partition walls, and no more openings to be made than are absolutely necessary. 5. That the iron columns, beams, and brick arches be of a strength sufficient not only to support a continuous dead pressure, but also to resist the force of impact to which they are subject. Lastly. That in order to prevent the columns from being melted, a current of cold air be introduced into the hollow of the columns from an arched tunnel under the floors. Mr. Braidwood argued that there could be no doubt, if the second principle could be enforced, a fire would go out of itself; but it was very doubtful if the object was not defeated by carelessness in leaving a door or a window open just at the time when a fire occurred. The fifth principle showed that Mr. Fairbairn had not laid sufficient stress on the loss of strength to the iron consequent on an increase of temperature; and the last principle, it was thought, would not be likely to answer the purpose, as a specimen of 1¼ inch cast-iron pipe, on being heated in the centre, with both ends open, and a current of air passing through it, gave way, on one end being held in a vice, and the other pulled with slight force by the hand, after an exposure of only four minutes in the fire. For these reasons and others, the author submitted that large buildings containing considerable quantities of combustible goods, and constructed on the usual system, were not practically fire-proof; and that the only construction which would render such building safe, would be groined brick arches, supported by pillars of the same material laid in cement. The author

was also of opinion that the loss by fire would be much reduced if warehouses were built of a more moderate size, and separated from each other by strong party walls, instead of being constructed in immense ranges, into which, when fire had once penetrated, it set at defiance all efforts to extinguish it.—*Athenæum Report.*

NOTES AND NOTICES.

Grand Mechanical Prize.—We quote the following notice from the *Times*: "Mr. Moreton, an American printer, died lately in Paris. He has bequeathed £40,000 to be given as a premium to anybody who shall succeed in constructing a machine capable of striking off 10,000 copies of a newspaper within an hour." The race, we presume, will be between our own distinguished mechanician, Mr. Applegath, and Mr. R. M. Hoe, of New York; both of whom have reached very nearly the degree of perfection stipulated for by this munificent bequest.—See vol. xlix., p. 193, and current vol., p. 12. See also the Notices of "Recent American Patents" in our present Number, p. 235.

The New Prussian Firelock.—The two regiments of Grenadiers of the Guards received, in the beginning of last month, muskets of the new model, called "Percussion-needle-firelocks" (*zundnadel gewehre*), the same as had been already supplied to the first and second regiments of the Guards of the Line, as well as to the Fusileer battalions throughout the army. The new musket is the invention of a Mr. Dreys, who is gunmaker-in-chief to the Prussian army, and its construction was kept a secret until the national armoury in Berlin was searched by the mob last year. The manufactory of the new muskets is principally carried on at Sommerda, a small town in Prussian Saxony. It has for many years been the head-quarters of a board of officers called "The Board of Revision," who have latterly had drafts of sub-officers sent to them from every regiment, that they might be trained to the use of this new gun, so as to be able to instruct their regiments upon their return to their own quarters. The principal superiority in Dreys' muskets consists in their ensuring a truer direction to the ball, and they carry it to a greater distance than any musket which has yet been invented. They differ in construction and appearance from the latter simply in the globular appendage, which takes the place of the old lock, and receives the pointed ball from the soldier's fingers; the musket being otherwise charged as usual from the muzzle of the barrel. The ramrod has no longer its former duty to perform, being solely applied to cleaning out the barrel. The important alteration made in the locks of the Prussian guns some years ago was also devised in the Sommerda manufactory, and thence travelled the round of the other public gun manufactories. Dreys' new musket well deserves the attention of all gun-makers. H. C.—*United Service Magazine.*

Gutta Percha Tubing.—This tubing is such an extraordinary conductor of sound, that its value, not only to deaf persons, but to the public generally, will speedily be appreciated. It has already been fitted up in dwelling houses, in lieu of bells,—as speaking tubes for giving and receiving messages in mines, railway stations, prisons, workhouses, hotels, and all large establishments, it is invaluable.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Edward Westhead, of Manchester, manufacturer, for certain improvements in the manufacture of wadding. March 3; six months.

Henry Constantine Jennings, of Abbey-street, Bermondsey, practical chemist, for improvements in the manufacture of vehicles for mixing pigments, and also in the manufacture of white lead. March 5; six months.

Nathan Defries, of Grafton-street, Fitzroy-square, civil engineer, and George Brooks Petit, of Brook-street, New-road, Middlesex, gas-fitter, for improvements in applying gas to heat apparatus containing fluids, and in heating and ventilating buildings, also improvements in gas-fittings and apparatus for controlling the passage of gas. March 5; six months.

Samuel Banks of West Leigh, Lancaster, miller, for certain improvements in mills for grinding wheat and other grain. March 5; six months.

William Henry Green, of Basinghall-street, London, gentleman, for improvements in the preparation of fuel. March 5; six months.

James Baird, of Gartsherrie, Old Monkland, Lanark, Scotland, iron master, and Alexander Whitelaw, of the same place, manager, for improvements in the method or process of manufacturing iron. March 7; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subject of Design.
March 2	1797	Theodore de Marillac	Manchester	Oil-can.
,,	1798	Henry M'Evoy	Birmingham	Point of a wire dress hook.
3	1799	John Lee Benham	Regent-street	Chair with a moveable back.
5	1800	Charles Wright	Sloane-square	Invisible revolving tip for boots and shoes.
,,	1801	Andrew Bertram	Glasgow	Hot-water apparatus.
6	1802	Clay and Son	Nuneaton	Folding meat hastener and plate warmer.
7	1803	David Thomson	Pimlico	Bucket pump.

Now Publishing,

Portrait of Baptist Noel,

IN THE

"PEOPLE'S JOURNAL."

WHICH contains, besides other valuable and interesting Articles, an Analytical Review of Baptist Noel's remarkable book on "The Union of Church and State."

Price Three-halfpence.

The March Part of the "PEOPLE'S JOURNAL," price Sevenpence, is Embellished with the Portraits of GEORGE DAWSON, A.M., and ROBERT VERNON, Esq., and two other beautiful Engravings, and comprises Original Articles by eminent writers, forming the best and cheapest periodical of the day.

Now ready, Vol. VI., price 5s. gilt, 4s. 6d. plain.

Also, just ready, Part VII. of THE UNIVERSAL PICTURE GALLERY, with four beautiful Illustrations from pictures by the best masters. Price Sixpence.

The "PEOPLE'S JOURNAL" ALMANACK for 1849 is now publishing, price Three-halfpence.

LONDON: WILLOUGHBY and CO., 13, WARWICK LANE.

GUTTA PERCHA COMPANY

PATENTEES. WHARF ROAD, CITY ROAD, LONDON.

Wharf Road, City Road, London.

IT cannot now be doubted even by the most sceptical, but that GUTTA PERCHA must henceforward be regarded as one of the blessings of a gracious Providence, inasmuch as it affords a sure and certain protection from cold and damp feet, and thus tends to protect the body from disease and premature death. Gutta Percha Soles keep the feet WARM IN COLD, AND DRY IN WET WEATHER. They are much more durable than leather, and also cheaper. These soles may be steeped for MONTHS TOGETHER in cold water, and when taken out will be found as firm and dry as when first put in.

Gutta Percha Tubing,

Being so extraordinary a conductor of sound, is used as speaking tubes in mines, manufactories, hotels, warehouses, &c. This tubing may also be applied in Churches and Chapels, for the purpose of enabling deaf persons to listen to the sermon, &c. For conveying messages from one room to another, or from the mast-head to the deck of a vessel, it is invaluable. For greater distances the newly-invented Electric Telegraph Wire covered with Gutta Percha is strongly recommended.

Mill Bands.

The increasing demand for the Gutta Percha strapping for driving bands, lathe-straps, &c., fully justifies the strong recommendations they have everywhere received.

Gutta Percha Pump Buckets, Clacks, &c.

Few applications of Gutta Percha appear likely to be of such extensive use to manufacturers, engineers, &c., as the substitution of it for leather in pump buckets, valves, &c. These buckets can be had of any size or thickness WITHOUT SEAM OR JOINT, and as *cold water will never soften them*, they seldom need any repair.

Gutta Percha Picture Frames.

The Gutta Percha Company having supplied HER MAJESTY THE QUEEN with several elaborate Gutta Percha Picture-Frames for Buckingham Palace, which have been highly approved by the Royal Family, fully anticipate a great demand for frames from the nobility throughout the country. In order that the picture-frame makers may not be injured, the Company will supply the trade with the mouldings, corner and centre pieces, &c., and allow them to MAKE UP the frames. Pattern books for the trade are now ready.

Gutta Percha soles, solution, inkstands, card-trays, medallions, picture-frames, brackets, mouldings, window-blind cord, soap-dishes, tap-ferrules, cornices, vases, fire-buckets, bowls, pen-trays, stethescopes, thin lining, thread, flower-pots, ear trumpets, &c., &c., manufactured at the Company's Works, Wharf-road, City-road, London, and sold by their Wholesale dealers in town or country.

Errata.

P. 173, for h=height of the side walls in yards." read $\frac{h}{2}$=height, &c.

Sir,—Permit me to point out a few errors which have occurred in the printing of my communication upon "Smith's Yielding Sea Barrier," which you did me the honour of inserting in the last Number of the *Mechanics' Magazine* (pages 199, 200).

For fig. 2 of the diagrams read fig. 1, and *vice versa*.

For $\angle AB_1 P=B_1$ read$=\beta$: and for cos B, read cos β.

$$\text{For } \cos B=\frac{R^2+l^2}{2Rl}-C^2, \text{ read}$$

$$\cos\beta=\frac{R^2+l^2-C^2}{2Rl}.$$

For tan δ, page 200, read tan β.

The very great accuracy which generally characterises the printing of the Magazine, renders it perhaps the more necessary that I should point out the errors which accidentally escaped notice in the present instance.

Very truly yours,

T. SMITH.

Bridgetown, Wexford, March 5, 1849.

NOTICES TO CORRESPONDENTS.

Mr. Lloyd's Patent Blower, described in vol. xlix., *p.* 265, *may be seen in successful work at Mr. Izzard's Grove Foundry, Southwark.*

F. E. M.—*There is no such patent, in the name either of "Rooke" or "Minister."—No charge for more particular information, if desired.*

A stamped edition of the Mechanics' Magazine, to go by post, price 4*d., is published every Friday, at* 4 *o'clock, p.m., precisely, and contains the Claims of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum* 17*s.* 4*d., half-yearly* 8*s.* 8*d., quarterly* 4*s.* 4*d. Post Office Orders to be made payable at the Strand Office, to Joseph Clinton Robertson, of* 166, *Fleet-street.*

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co. Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1336.] SATURDAY, MARCH 17, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

SIEMENS'S SURFACE CONDENSER.

Fig. 1.

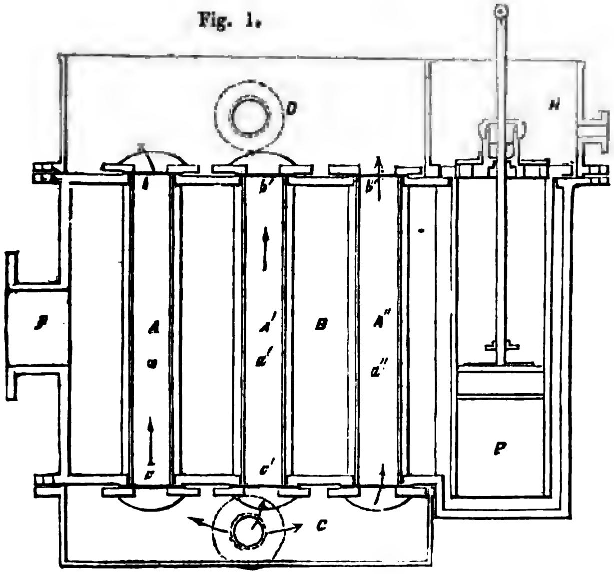


Fig. 2.

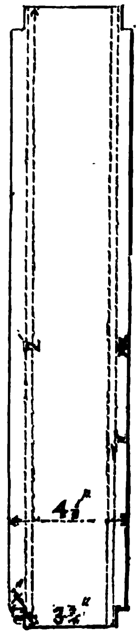


Fig. 3.

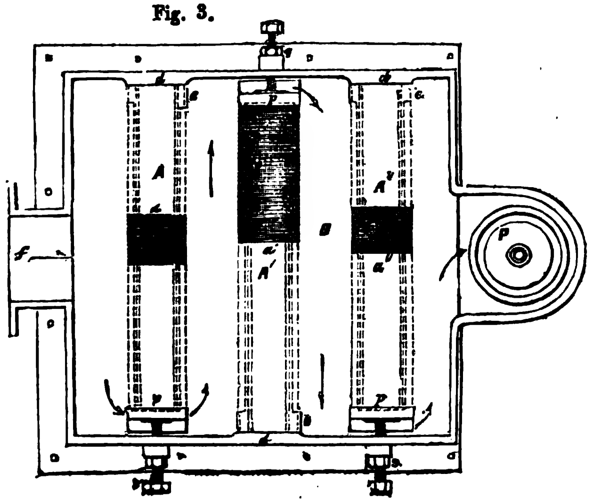
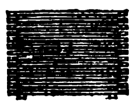


Fig. 4.



DESCRIPTION OF AN IMPROVED SURFACE CONDENSER, INVENTED BY MR. W. C. SIEMENS, C. E.

Mr. Editor,—The following is a description of a new surface condenser, which is of simple construction and effective in action. I am desirous to see it brought into public use, but being in pursuit of other objects, I cannot afford time to carry it out myself; and, since it is not subject to any patent, I think that engineers may feel induced to try it if you consider its description worthy of a place in your Magazine.—I am, &c.,

W. C. SIEMENS.

Birmingham, Feb. 19, 1849.

Description.

It is generally admitted that an efficient surface condenser would be a desideratum for marine engines, and for stationary engines in localities where pure water cannot be obtained; but if it could be made sufficiently simple, and not liable to derangement, I think that it might ultimately supersede the injection condenser altogether, because it would entirely prevent incrustation of the steam boilers (which would consequently transmit the heat of the fire more readily, and be less liable to destruction), and save above three-fourths of the power which is consumed in working the air pump of an injection condenser. The repeated efforts which have been made by Mr. Hornblower, Mr. Hall, and others, have, however, left the problem yet practically unsolved, which I consider is principally owing to the circumstance that a sufficient amount of effective condensing surface could not be obtained, without rendering the apparatus heavy, complicated in its construction, and consequently very expensive—three qualities which suffice to condemn any machine, however perfect in other respects it may be. The action of a surface condenser is dependent upon three distinct operations:—

1. The steam is brought in contact with extended cooling surface, which absorbs its latent heat, and thereby condenses it.

2. The heat is conducted from the condensing surface through the body of the metal to the opposite surface, where

3. It is taken up by a current of water (or air, as Mr. Craddock has proposed) of inferior temperature.

The heat passes through these three stages with very unequal rapidity; but the condensing power of the apparatus is limited by the slowest of these operations; hence it follows that a tubular or other surface condenser, where the condensing surface, the surface of contact between metal and water, and the area of the metallic channel which conducts the heat from the one surface to the other, are all of equal development (or very nearly so), is not constructed according to a matured system of accuracy.

My own observations lead me to suppose that condensation would be accomplished with inconceivable rapidity if pure steam were brought in contact with a surface which could be maintained perfectly cool, but in practice it is limited by three circumstances, viz.:—

1. The limited conducting power of the substance which is to absorb the heat.

2. Particles of permanent gases, which are generally mixed with steam, prevent the immediate contact between the particles of steam and the condensing surface.

3. The inertness of the steam itself, prevents the instantaneous replenishment of the vacuous space surrounding the condensing substance.

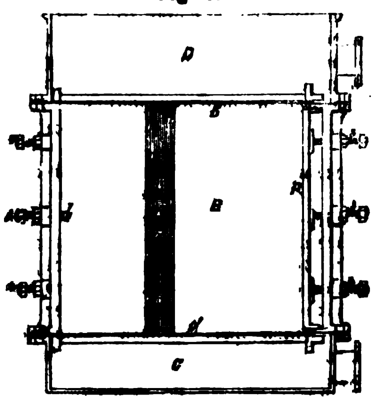
With reference to the conducting power of metals, much remains to be learned; but it has been found, that if two vessels of good conducting material, such as silver or copper, and similar shape, but of very different thicknesses of metal (varying from one-sixteenth of an inch to one inch, or more), are exposed to the same source of heat, water will boil with equal rapidity in each of them, which proves that the transmission of heat through the metal is much more rapid than its absorption by the water. Of this circumstance, considerable advantage can be taken, in constructing a surface condenser which receives its charges of heat from the steam cylinder at intervals, and allows the time between such intervals for its transmission through the metal and its absorption by the water.

The passage of the heat from the metal to the water, is evidently the slowest of the three processes through which it has to pass, because water is a very bad conductor of heat, and its fitness to absorb heat from heated surfaces is only to be attributed to its circulating or onward

motion, whereby continually fresh particles are brought into immediate contact with the heated surface.

In constructing the surface condenser, which I am about to describe, I provided as much of this latter surface as has been found requisite in Mr. Hall's condenser, or about 20 square feet per horse power, and endeavoured to proportionate to fit the requisite amount of condensing surface and of conducting medium between them. Fig. 1, represents an elevation in section; fig. 2, an end view in section; and fig. 3, a plan of my new surface condenser. It consists of a cast-iron box B, an air-pump P, a hot well H, for the condensed water, a cold water chamber C, and a cistern D, for the reception of the heated condensing water. The cold water chamber C, communicates with the cistern D, through narrow channels, *a*, *a*, between series of copper plates, A A^1 and A^2, which are constructed in the following manner:—A sufficient number of copper plates of about three-sixteenths of an inch thickness, are cut to a shape as represented separately by fig. 4. The total length of these plates is equal to the entire depth of the box, B, and they are notched at the four corners, so that they can be put side to side into the box with their reduced ends projecting through the longitudinal openings, *b c*, b^1c^1, b^2c^2, in the top and bottom surfaces of the box, B. For every plate two straight pieces of flattened copper wire, of the sectional area of about one-eighth of an inch by one-quarter of an inch, and of a length exceeding that of the plates by about half an inch, are also provided. In compiling the ranges, A, A^1, A^2, one of the copper plates is passed through the longitudinal opening, *b*, and is laid flat against the prominent part, *d*, of the box, with its diminished ends reaching through the openings, *b*, *c*. Two flattened wires are laid parallel to each other, with their flat sides against the plate, their ends projecting both ways through the box, B, and touching the sides of the openings, *b* and *c*. Upon these two wires another plate is laid, and upon that again two flattened wires in the same relative position as the preceding two, and so on, until the pile of plates and wires is raised through nearly the whole breadth of the box, B. The pile is completed with a strong iron plate, *p*, and is compressed by means of three set screws, *s*, *s*, *s*, until the flattened wires have actually indented the copper plates, and by virtue of their close contact, made perfectly impregnable metallic joints, whereby the spaces between the flattened wires are separated from the interior of the box. The orifice, *b*, is widened at *e*, at which place the last few plates are slipped into the box. After the three sets of copper plates and wires are duly compressed, they are planed off at the ends level with the top and bottom surfaces of the box, B, and caps or flanges, *f f*, with vulcanised India rubber rings, are screwed against them, which stop up the communication between the interior of the box, B, and the hot and cold water chambers, D and C. Fig. 5 shows an enlarged end view of some plates with the interposing flattened wires. The working of this condenser will be readily understood.

Fig. 5.



The waste steam of the engine enters the box, B, through the pipe, *f*, and is readily condensed by the projecting edges of the copper plates, from whence the heat is conducted towards the middle of the plates, and is continually absorbed by a current of cold water which passes from the cold water chamber, *e*, upwards into the hot water cistern, D, through the narrow channels between the plates. The condensed water collects upon the bottom of the box, B, and is continually discharged (together with the permanent gases) into the hot well, H, by means of the air-pump, P, from whence it is forced again into the boiler.

The following I consider to be the recommendations of this condenser:

1. The greatest economy of material and metallic surface is realised by means of its correct distribution.

2. A large extent of useful surface is brought within a limited space—a column of plates and wires of 2 feet length, 2 feet height, and 4½ inches breadth, containing about 100 square feet of surface in contact with water.

3. Comparatively little condensing surface will be used, because none can escape, without having been for some time in close proximity with heated surface, and thereby nearly imbibed the temperature of the steam itself.

4. Easy access can be had to every part of the apparatus, especially to the water channels between the heated plates.

5. It is of simple construction, moderate expense, and is not liable to derangement in consequence of unequal expansion or other causes.

In conclusion, I may add that I had an occasion to build a condenser on this principle for an experimental engine of about eight horses' power, which fully answered my own expectations.

C. W. SIEMENS.

STEAM BOILERS.—STENSON'S AND MEDWORTH'S.

Sir,—My last communication did not represent Mr. Stenson as having copied Mr. Beale's boiler, but as having patented one precisely like my own (with smoke-box in the steam chamber, &c.), and which Mr. Stenson *examined* at York, the only addition being the bent pipe through the fire-box.

This pipe *may* be an improvement; but in my boiler it certainly was not necessary, because of the ample water space around the fire-box, and because it required only to work at the pressure of four pounds to the square inch. I am, therefore, so far unable to appreciate the result of his twenty-five years' experience, but cannot plead guilty to the charge of ignorance as to the value of a good circulation—because, for many months, I have been making the boilers to what is known as "Stanley's Farmers' Steaming Apparatus," in which the principle is carried out in a greater degree ven than in Mr. Stenson's.

If the arrangement of fig. 28 is good, Mr. Stenson must allow me some merit (especially as it did not occupy my mind *twenty-five hours* in inventing.) If it is bad, why copy it? I am, &c.,

JNO. MEDWORTH.

Walworth-road, March 13, 1849.

MR. RICARDO'S PATENT FOR THE INSULATION OF ELECTRIC TELEGRAPH WIRES.

Sir,—It appears to me that there are other patentees besides those mentioned by you, whose *claims* will affect Mr. Ricardo's patent for the insulation of electric telegraph wires, of the specification of which an abstract appeared in your last Number.

The arrangement which constitutes claim 2 is exactly similar to that patented two years ago by Mr. Moses Poole* (a communication from abroad.) It is described in Part F of his specification (enrolled June 14th, 1847), and is the subject of figs. 1, 2, and 4, sheet IV. of the drawings. The only difference, if such it can be called, between the two plans, is, that in Mr. Ricardo's arrangement, the earthenware cylinder is filled up at the top with cement, which holds in the hook; whilst in that of Mr. Poole, which is obviously superior, the whole is of solid earthenware, and the hook is supported inside by the peculiar form of the earthenware.

There is a serious objection to Mr. Ricardo's plan of combining together a number of wires between two fillets of gutta percha, viz., the currents of electricity which would be *induced* in the wires nearest to those conveying the primary current, and which would, in some cases, act powerfully upon the needles or other telegraphic apparatus.

The *title* of Mr. Ricardo's patent is not correct; as no "improvements in *electric telegraphs*" are described in the specification,—only in the insulation of the wires which convey electricity from one telegraph to another.

The arrangement of heated grooved rollers for covering the wires with gutta percha is not new.—(See Messrs. Barlow and Fosters' patent, *Mech. Mag.*, vol. xlix., p. 497; see also p. 100 current vol.) I am, &c., G. D.

P. S.—There is a question which seems to have escaped the notice of most persons who have tried experiments, or patented plans for covering electric telegraphic wires with gutta percha, viz., what will be the effect of *time* upon this material when it has been buried in the earth or submerged in salt water? No one can at present tell, and it must be left to experience to prove how the fact stands. The subject is alluded to in the letters before referred to, published at p. 99 of your present volume, but nowhere else have I seen it mentioned.

March 14, 1849.

* See *Mech. Mag.*, vol. xlvii., p. 41.

LONDON FIRES IN 1848.—BY MR. W. BADDELEY, C.E., INVENTOR OF THE FARMER'S FIRE-ENGINE, PORTABLE CANVAS CISTERNS, IMPROVED HOSE-REEL, ENGINE LAMPS, SPREADERS, ETC., ETC.

" The eternal surge
Of time and tide rolls on, and bears afar
Our bubbles; as the old burst, new emerge,
Lash'd from the foam of ages; while the graves
Of empires heave but like some passing waves."

BYRON.

"The statistics of London fires are by no means devoid of interest, and the time may come when they will form an index to the social advancement of the people; for in proportion as houses are built more and more fire-proof, and habits of carefulness become more and more diffused, the number of destructive fires will assuredly lessen."—*Knight's London.*

The eventful year of 1848 has passed " the brittle boundary of time," and left most of us wiser—may we hope, better—than it found us.

While public attention has been occupied with the convulsions of surrounding nations, the current of domestic occurrences in England's favoured metropolis, unlike " the course of true love," has been remarkably smooth. We have passed another year comparatively unscathed by the visitations of the " Fire King." The number of fires in London during 1848, has been 805; 31 less than in 1847, although the total number of calls, 1011, is slightly in excess.

Of these fires, 217 have been extinguished by the inmates without further aid; 360 have been extinguished by the inmates with casual assistance; while the extinction of 228 has devolved upon the firemen.

Subjoined is a tabular view of the periods of their occurrence:

MONTHS.	Number of Fires.	Fatal Fires.	Number of Lives Lost.	Chimneys on Fire.	False Alarms.
January	91	1	1	10	9
February	62	1	1	11	7
March	61	2	2	9	10
April	52	0	0	4	7
May	86	1	1	5	6
June	63	3	3	6	11
July	54	1	2	6	14
August	69	2	2	7	10
September	47	3	4	4	8
October	63	0	0	6	13
November.....	69	2	3	8	15
December.....	68	0	0	10	10
Total......	805	16	19	86	120

Of these, there were entirely consumed	27
Seriously damaged..	269
Slightly damaged	509
	805

Chimneys on fire	86
False alarms	120
Making the total number of calls	1011

The number of instances in which insurances were known to have been effected upon the building and contents, was	310
On the building only...	120
On the contents only...	134
Uninsured	241
	805

The *fatal* accidents, which are still numerous, may be resolved into the following classification:

From ignition of apparel, &c.	9
—— falling buildings	3
—— explosion of gas	1
—— suffocation	1
Inability to escape from burning buildings	5
	19

Of the latter, *only two* lives were lost within the district of the *Royal Society for the Protection of Life from Fire*; the other *three* persons perished in localities not under the protection of this Society.

The following fires are deserving of special notice:

Tuesday, January 11, 8½ A.M. Vaults beneath the venerable church of St. Saviour, Southwark. The assistance of the Brigade, and West of England engines, having been obtained, a quantity of water was thrown into the vault, until the smoke was so much abated as to permit the entrance of the firemen, who soon extinguished the remaining fire. On examination, it was found that a quantity of sawdust and some coffins had been consumed, and several others much injured. The fire had been occasioned by a spark falling from the candles used at a funeral the day previous.

The preservation from destruction of this beautiful edifice, so rich in its historical associations, reflects much credit on the skilful exertions of the firemen, and is a source of gratification to every antiquary.

Saturday, January 22, 4¾ A.M. Burlington Arcade. The peculiar construction of the buildings, and the confined nature of the locality, coupled with a vivid recollection of the devastation occasioned by a previous conflagration, gave rise to the most fearful apprehensions. The fire was first seen raging in the shop of Mr. Russel, walking-stick and umbrella manufacturer. The engines of the County, Brigade, and West of England Offices, arrived in quick succession, and being placed in suitable positions in Piccadilly, Bond-street, and Burlington Gardens, were worked most vigorously upon the burning buildings. After an arduous struggle, the flames were vanquished; the premises of Mr. Russel being entirely destroyed, and eight other buildings more or less severely damaged.

Tuesday, February 2, 1½ A.M. "Red Lion" public-house, Red Lion-court, Fleet-street. The fire was first perceived by the pot-boy, who made a precipitate retreat and gave an alarm. Upon rousing the inmates who were asleep in the upper part of the house, escape by the stairs was found impracticable, and they appeared at the second-floor window crying for help. The police jumping-sheet being brought, the landlord's son, and a female servant, threw themselves into it, but the other parties declined following their example, preferring to wait the arrival of some other assistance. In a very few minutes Conductor Fewster arrived with the Royal Society's Fire-escape from Bridge-street, (closely followed by Conductor Robinson with that from St. Clements). Fewster having placed his escape at the window, ascended and brought down Mr. Hoare, his two daughters, and the bar-maid, in perfect safety amid the cheers of the anxious spectators. A gentleman lodging in the house escaped in his night shirt, by dropping from a back window on to an adjoining roof. The Brigade engines from Farringdon-street and other stations, and the West of England, taking advantage of a good supply of water succeeded in arresting the flames, but not until the premises were very seriously damaged; the staircase was burned away and the roof nearly destroyed.

Tuesday, March 14, ½ A.M. For the second time within nine months, the shop of Mr. Hill, ironmonger, 94, Goswell-road, was discovered to be on fire. Mr. and Mrs. Hill (the only inmates) were asleep in the second-floor front room, and upon being roused, found the stairs in flames, and escape in that direction impracticable. They then returned to their room and opening the window implored aid, which was soon afforded by the prompt arrival of Conductor Kaines, with the Royal Society's fire-escape from Islington-green, and Conductor Wilson with that from St. John-street. Mr. and Mrs. Hill were safely brought down the escape by Kaines, and the fire speedily extinguished by Mr. Brown with the Islington engine.

Great credit is due to the conductor for the speed with which he attended. His arrival was at a moment of intense excitement, from its being apparent that the persons at the window were about to precipitate themselves into the street. Mr. Hill writes,—"I firmly believe that had the escape not arrived just when it did (within five minutes after the fire broke out), the lives of myself and Mrs. Hill would have been lost."

Tuesday, March 21, 1½ A.M. "Grapes" public-house, Duke-street, Lincoln's Inn-fields. Promptly attended by conductors Robinson and Chapman, with the St. Clement's and Hart-street escapes. The former conductor ascertaining a female was missing, ascended his escape, and, after a diligent search, whilst the engines were playing upon the roof, found the bar-maid lying insensible in the gutter, where she had only been able to get on her hands and knees, and where she must have perished but for the timely discovery. She was immediately taken to the hospital. By the exertions of the Brigade and West of England firemen the fire was extinguished; the upper floors of the house were all severely damaged and the roof destroyed.

Monday, April 10, 2¾ A.M. Kendall, coffee shop keeper, 33, Goswell-street. The flames soon involved the adjoining premises, and communicated to the extensive back warehouses and stores belonging to Mr. Schlenker, oilman and drysalter. Whilst the firemen were exerting themselves to the utmost, the flames reached a parcel of gunpowder which exploded with awful violence, but happily without doing any serious personal injury. The back premises being composed entirely of timber, and in a confined situation, rendered the extinguishing of the fire a work of considerable difficulty, but it yielded, at last, to the praiseworthy exertions of the Brigade.

This fire was remarkable from the circumstance of its not being attended by a single *policeman*; the ground was, however, admirably kept by Her Majesty's loyal *special constables*.

Friday, May 5, 3½ A.M. Mr. Peaty, grocer, 68½, Holborn-hill. This and the adjoining buildings were of great antiquity, and so intricate in their internal arrangements, that it was difficult to decide in which part the fire was raging. On hearing the rattle, Conductor Sunshine, with the Royal Society's fire-escape, from Hatton-garden, was instantly on the spot, and finding the lower part of the house (No. 67) in flames, he placed his escape against the second-floor window, and rescued from thence the person of Mrs. E. Corpe. Whilst thus employed, Conductor Chapman arrived with the Bridge-street escape, and hearing there were

inmates in danger at the back of the house, he, with the assistance of police constable Smith, made an entry into the next house with his short ladder, and together they succeeded in getting on to the back leads, through the sky-light, at the end of Mr. Lloyd's shop; from thence, hearing the cries of several persons for help, they got over a wall and across the roofs of two out-buildings, and, by dint of great perseverance, placed the ladder against the back second-floor of No. 68. The conductor brought the first person down, who proved to be Mrs. Winter, with whom he made the best of his way back, over the roofs, followed by the other parties, Vincent, Charles, and Joseph Winter, and George Peaty,—the fire at the time, coming through the tiling, which they were only able to tread across by making a bridge of the short ladder, and had hardly all got clear over into Mr. Lloyd's premises, before the whole of the premises where they had been fell in.

[A memorial, embodying the foregoing statement, and recommending the conductor, and the police assisting, for reward by the Society, was forwarded to the committee, signed by the six persons saved, and seventeen householders of Holborn-hill.]

While this was being achieved, the engine from the Brigade station in Farringdon-street had arrived, and commenced working on the fire; by the sudden and unexpected fall of the buildings, Nos. 67 and 68, two of the firemen were overwhelmed in the ruins, but fortunately were extricated without any serious injury, and the fire soon extinguished.

A court of inquiry into the circumstances connected with this fire was held by Mr. Payne, the City Coroner; from the evidence taken at which, it was established that the fire commenced at the back of the shop occupied by Mr. Peaty, between 67 and 68, but how the fire originated could not be made out. The jury returned a verdict the fire was accidental, and expressed the greatest satisfaction at the conduct of the fire-escape conductors, by whose intrepid exertions a serious loss of life had been prevented.

Monday, May 15, 3½ P.M. Messrs. Cook, Sons, and Co., Nos. 21 to 25, St. Paul's Church-yard. On the arrival of the firemen, they found the scene of mischief was the piece-room on the upper floor, but the fire had been extinguished by the timely exertions of the inmates; the damage being confined to the destruction of twenty-five cotton dress and waistcoat pieces, and eighteen squares of glass.

In the report to the insurance offices, the "cause of fire" is thus returned—"A linen curtain, which hung before a back attic window, took fire at the open part of the window. The windew faces the south, and being higher than the opposite buildings, is completely exposed to the sun." The next day's papers gave an account of "*A fire caused by the sun.*" But how the sun's heast, without the interposition of a lens (natural or artificial) could ignite a linen curtain was not explained. Unfortunately, too, for any such supposition, another alarm of fire originated in the same premises on the Friday following, when some waste paper and fire-wood near the copper, took fire in an equally unintelligible manner: the latter occurrence was not attributed to the sun.

Tuesday, May 30, 9½ P.M. Messrs. Brown and Co., chicory manufacturers, St. Mary-street, Whitechapel. The premises having been originally built for a sugar refinery, were very extensive, and eight stories in height. The workmen left the manufactory at 7 o'clock, when all appeared safe; but, at the time stated, the flames burst forth with fearful violence, extending from floor to floor with great rapidity. The engines of the parish, Bridge, West of England, and County were promptly in attendance, and vast quantities of water were poured into the devoted building, but without avail. The exertions of the firemen, however, saved the adjoining premises, which were for a time in great peril. On Friday forenoon, a portion of the walls fell with a tremendous crash, overwhelming a man named White, who expired from the injuries shortly after in the London Hospital.

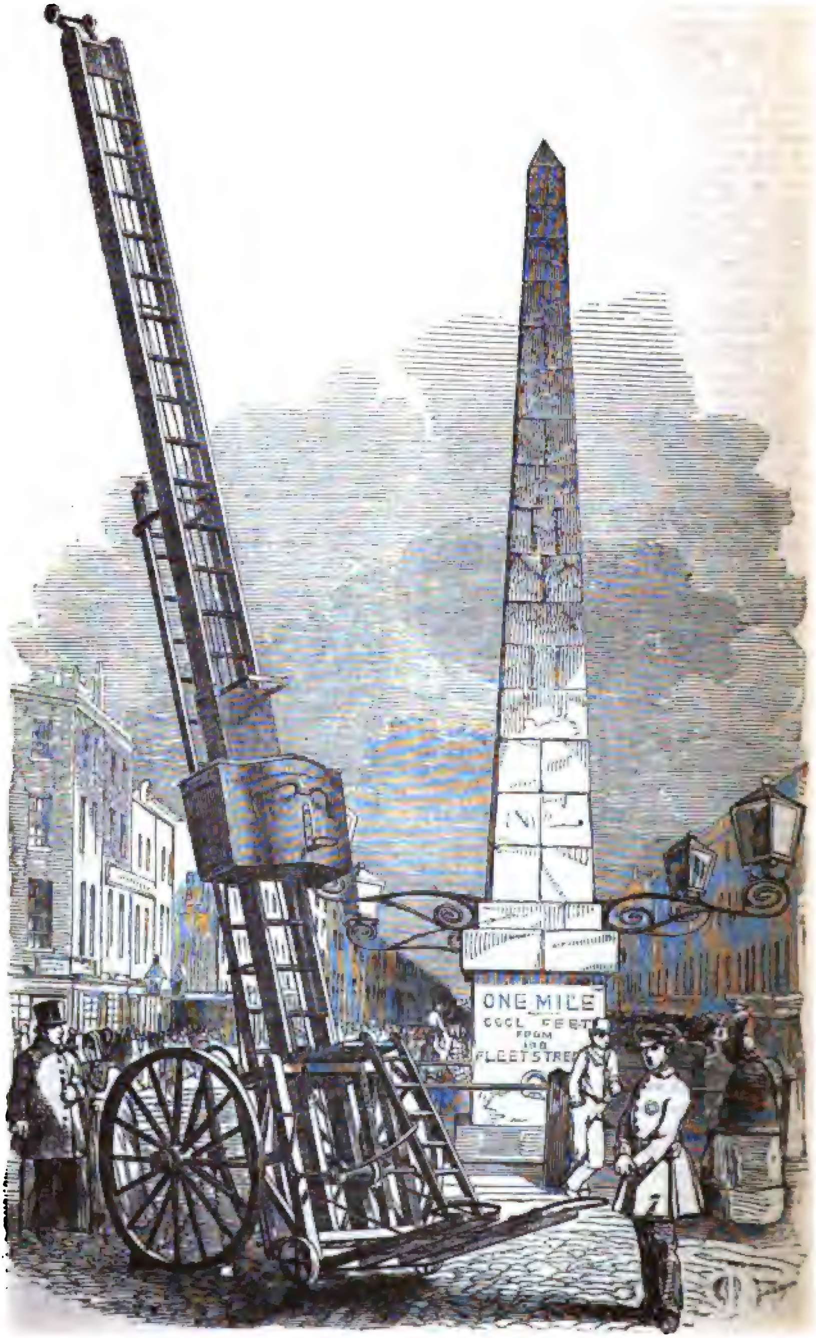
Tuesday, June 6, 9½ P.M. The Park Chapel, Grove-street, Camden Town, was found to be in flames. This chapel, built for the Independents in 1844, was of large dimensions, and substantially constructed. The fire ran through the edifice with surprising rapidity. On the arrival of the brigade and West of England engines, the supply of water was found to be wholly inadequate to their requirements, barely sufficient being obtained to work two engines. The contents of the chapel were entirely consumed

Friday, July 28, 4½ A.M. Messrs. Lawford and Westrupp, millers and ship biscuit bakers, New Crane, Shadwell, Wapping. When Mr. Mackay arrived with the Brigade engine from Wellclose-square, the fire was raging in the upper floor of the building, and the hose being led up to the floor below, a bold attempt was made to arrest the progress of the flames. The effort would most likely have been successful but for the giving way of the floor above, which fell with a tremendous crash, burying two of the Fire Brigade, named Piercy and Handcock, in the ruins. Mackay himself was knocked down, and got out much hurt. Engines from the other stations of the Brigade and West of England, as also the powerful floating engine, being brought to bear upon the building, the fire was at length subdued and the ruins entered. After several hours' exertion in getting through the mass of ruins and heavy machinery which interposed, the lifeless bodies of the two men were found. They were lying some distance from each other, and in such a position as to induce a belief that they knew their danger, and were endeavouring to escape from it. At the coroner's inquest held the day following, Mr. Fogo, foreman of the eastern district of the Brigade, stated, that on arriving with his engine at the fire, he found two engines at work (to one of which, (Wellclose-square,) the deceased were attached. He followed the hose up to the second floor, and hailed the men, when Mackay answered, "all right." He then returned to the street to give some necessary orders, when the floor fell in. From the appearance of the building, and not knowing the immense weight of machinery with which the upper floor was loaded, the men thought themselves in a secure position, and so did he: he could not attach blame to any one. The cause of the fire was attributed by the firemen to friction of the machinery; but the owners disputed this, because the mills ceased working at 6 o'clock on Thursday evening, and the fire did not break out until after 4 o'clock on Friday morning. The Jury eventually returned a verdict of "accidental death while engaged in extinguishing the fire; but how the fire was caused, there was no evidence to prove."

In reply to a question put by the foreman of the Jury, Mr. Braidwood said, "the widows of firemen were not allowed pensions. Formerly they were; but it led to such abuse and immorality, that the insurance companies discontinued the practice."*

* As Mr. Braidwood did not speak from his own experience, it is to be hoped he has been misinformed. But, if any such instance of "*immorality*" is on record, probably it may have originated in the pension having been accompanied, (as is too frequently the case,) with the arbitrary and unnatural condition of *forfeiture on re-marriage!* The managers of the London Fire-engine Establishment subse-

DAVIES'S FIRE ESCAPE.



On Wednesday afternoon, the remains of Piercy and Handcock were interred in the churchyard of St. George's in the East, with all the usual marks of respect from their comrades and officers, who most sincerely lamented their untimely end.

Monday, August 7, 10, P.M. A most terrific explosion of gas took place in the shop of Mr. Loten, dealer in Berlin wool, No. 60, Albany-street, Regent's-park, by which that house was entirely destroyed, and every building in the immediate vicinity to the number of more than a hundred, injured in a greater or less degree. All the gas was blown out, leaving the street in darkness, and Mary Bentley, aged fifteen, servant to Mr. Loten, who was standing at the private door of his house, was blown against the house on the opposite side of the street with such violence that she was killed on the spot. The wreck of Mr. Loten's dwelling being fired by the explosion, a detachment of the Royal Horse Guards, Blue, with their engine from the adjacent barracks, was promptly in attendance, followed by the engines of the Brigade, County, and West of England, by whose joint exertions the progress of the fire was stayed. A very lengthened investigation of every circumstance connected with this fatal accident took place before Mr. Wakley, the coroner, from which it appeared that the occupier of the above premises, with his family, being out of town, the house was left in charge of his brother, Mr. J. L. Loten, and his wife's sister, Miss Jane Burgh. On the night of the accident the shop was closed at 9 o'clock, as usual, by a lad named Lucas, who, in drawing the shutters from their usual depository beneath the stall board, struck the gas meter with one of them, but was not conscious of having injured it. At five minutes before 10 o'clock, a servant went up to the second-floor, and told Mr. Loten that supper was laid in the back parlour behind the shop. Mr. Loten and Miss Burgh accordingly went down stairs, when they perceived a strong smell of gas, and on entering the parlour, Miss Burgh asked "had we better not see where the gas is escaping from?" Mr. Loten replied "yes," and, taking a candle, opened the door leading from the parlour to the shop, on entering which, and holding the candle over his head, an explosion took place, the report of which was heard for miles round. The servant, as before stated, was forced across the street, while Mr. Loten and Miss Burgh were blown through the back part of the house into the yard, and although much bruised and burned, most miraculously escaped destruction.

Although many serious explosions have been occasioned by gas, nothing of the kind, since its first introduction, ever displayed such destructive violence, or created so much havoc and devastation as the foregoing. The public denied the possibility, and many scientific men were sceptical as to the probability of the comparatively small quantity of mixed gas present on this occasion producing such dire results. The witnesses were closely questioned as to the possibility of gun cotton, or other explosive compound being on the premises, but this was satisfactorily shown not to have been the case. The shop was very close, the previous occupier forgetting that *fresh* air was as necessary as *warm* air, having all the doors lined with leather "*to keep the cold out.*" Some part of the gas-meter, or supply-pipe being broken, the gas rapidly entered the closed shop and became mixed with the atmospheric air, and had evidently attained its most explosive proportions when Mr. Loten entered with the candle.

The Coroner, Mr. Wakley, informed the jury "that in order to come as far as possible to an elucidation of the circumstances which had caused this unfortunate and most extraordinary explosion, and to satisfy the public mind, he had requested the attendance of Dr. Arnott, to give his opinion as to the explosive power of gas."

Dr. Arnott being sworn, said, "I am author of the work entitled '*The Elements of Physics*,' which treats upon subjects connected with the explosion of gases, to which I have directed my attention. I inspected the premises and neighbourhood of Albany-street, a few hours after the occurrence, and having heard the evidence, I say that I believe an admixture of coal gas and common air capable of producing such an explosion. One measure of ordinary coal gas requires ten measures of atmospheric air to render it in the highest degree explosive. The greatest explosion that can be attained will be effected by these proportions. The result of such a mixture would, in my opinion, be to increase the volume about fifteen times; that is to say, a room containing one part of coal gas and ten of common air, would expand sufficiently to fill fifteen rooms with the same mixture, and the explosion of the whole would be instantaneous. Gunpowder is nothing more than gas very much condensed; a cubic foot of the mixed gases (coal gas and atmospheric air), was equal to half an ounce of gunpowder. I never knew of a catastrophe of this kind before, but think it quite possible it has been produced from an explosion of gas: Gas ascends to the top of a room, and there remains usually at the top of the air, as oil does upon water, and the more it is mixed with atmospheric air, the more explosive it becomes. The best means of preventing such accidents is, to have a ventilator at the top of each room in the chimney. Gas ascends almost three times as much as ordinary smoke, and the draught in the chimney would be sure to carry it off, inasmuch as a chimney always acts as an air pump."*

After a very lengthened and searching inquiry, the jury returned a verdict that "the death of Mary Bentley was caused by a mortal fracture of her skull, occasioned by the accidental explosion of an admixture of coal gas and common air, in the house numbered 60, Albany-street, and that, whether the said coal gas escaped into the said shop in consequence of an accidental blow given to the meter or fittings thereof by the removal of a certain window shutter, there is not before the jury sufficient evidence to show."

quently voted a sum of money to Handcock's widow, who was left without any family. A donation, was also given to Mrs. Piercy, who had just been confined with her second child; the eldest, a boy aged three years, was got into the *Infant Orphan Asylum, Wanstead*, at the election in November; and the infant daughter is a candidate for admission to the same institution, at the forthcoming election in April next. A small weekly sum has been allowed Mrs. Percy until the children are both taken off her hands.

* The *Times*.

Tuesday, August 29, 4½ A.M. Mr. Clare, tobacconist, No. 8, Friar-street, Blackfriars-road. Mr. Clare, his wife, and infant son, were at the time asleep on the second floor, and, on being roused, found such volumes of smoke ascending the staircase as to cut off all possibility of escape in that direction. To precipitate themselves from the second floor window seemed the only alternative, and, accordingly, Mr. Clare tore out the sash, and threw some bedding into the street, preparatory to leaping from the window, when Conductor Wood, with the Royal Society's fire-escape, arrived most opportunely from the Obelisk, and brought the family safely down with the machine. The Brigade and West of England engines were soon in attendance, and the fire extinguished, being confined to the back parlour and shop, which, with their contents, were much damaged. The fire had originated from a spark dropped over night, and had been smouldering several hours when discovered.

Friday, Sept. 1, 11¾ P.M. Mr. Coney, stationer, &c., 61, Wardour-street, Soho. The discovery was made by a police constable, who instantly raised an alarm and roused the inmates, who were very numerous, and for the most part asleep in bed. Aided by the police and neighbours, the inmates effected a safe retreat by the private door, with one exception. Florence Elizabeth Dezouch, Mrs. Coney's daughter by a former husband, had been put to bed early in the evening by Grace Boyd, in whose charge she had been left during the temporary absence of her parents. On the alarm of fire, Grace Boyd attempted to rush up stairs for the child; but the police, anxious to ensure her own safety, compelled her to leave the house. She, however, loudly proclaimed the fact of the infant's peril, when Mr. James, a respectable inhabitant of Wardour-street, ran for the fire-escape belonging to St. James's parish, which (as he afterwards deposed on oath) "he met at the corner of the street, coming slowly along, and begged of the man in charge, for GOD's sake, to make haste, as life was in danger." He accompanied the man to the burning building, and assisted him to place his escape, directing him to the second floor window, over the gateway. The conductor ascended, and entered the window, but hastily returned, saying, "there is no child there." The rapid spread of the flames prevented further search, and the engines having arrived from the County and Brigade stations, were set to work, and the fire stopped. As soon as the premises, which were seriously damaged throughout, could be entered, Paul Girard, engineer of the Crown-street Brigade station, ascended, and found the body of the child lying on its back in the second floor front room, with its head towards the door between that and the back room; and he declared that no person could have passed from the front room to the back without tumbling over the deceased. James Duggen, conductor of St. James's fire-escape (whose unfitness for this service had caused his discharge long since from the Royal Society for the protection of life from fire), on being sworn at the inquest, endeavoured to screen himself by stating that he went into the window *over the shop*, not that *over the gateway*; but this was positively contradicted by a number of respectable inhabitants of Wardour-street, and by some of the Jury, who saw Duggen enter the very room in which the child was afterwards found. It was evident to all persons present at the inquest, that his cowardice had prevented his going far from the window. Some of the jurors were desirous of expressing their opinion of Duggen's conduct, but were overruled by Mr. Bedford, the coroner, and a verdict of "accidental death" was ultimately returned.

Monday, September 11, 10 P.M. *Teaser* schooner, St. Katherine's Docks. Mr. Kitchen, the principal fireman, having got one of the dockyard engines to work, descended into the forecastle, where he found a number of sails burning, and the place so hot and full of smoke that he could not remain many seconds. Having succeeded in extinguishing the fire, he found about ten sails partly destroyed, the under side of the deck, sail cabin, and forecastle, severely damaged, and a sailor lying in the forecastle quite dead from suffocation. The fire had been occasioned by some unextinguished tobacco falling among the sails. An inquest was held, and a verdict of "Accidental death" returned.

Saturday, September 16, 2½ A.M. No. 25, Whitechapel-road, occupied by Mr. Watkinson staymaker, and others. The fire was first discovered in the shop by a private of the Grenadier Guards, who gave an alarm, and tried to rouse the inmates. These consisted of Mr. Watkinson, who with Samuel Taylor Pitts, aged 13, slept in the first-floor, while Mr. and Mrs. Pitts, with two more children, occupied the second floor. On hearing the cry of "fire," Mr. Watkinson arose and shook the boy, telling him to "get out of the window, as the house was on fire." Mr. Watkinson then ran up stairs and awoke Mr. Pitt and family, and catching up the youngest son, he descended to the first floor, and Mr. Pitts, having got out on the shop front, they passed the child down to the soldier. Mrs. Pitts followed down stairs with her daughter Priscilla, aged 8, both being much burned by the fire raging round them; the daughter was passed out of window to the soldier, and conveyed to the hospital; Mrs. Pitts, who had fainted, was dropped out of window, and fell to the ground, no person being there to receive her. Mr. Watkinson and Mr. Pitts then descended, supposing all had escaped. The Parish, Brigade, West of England, and County engines arrived, but the burning premises soon fell to the ground, and the firemen succeeded in saving the adjoining premises. As soon as the ruins were cool enough to be entered, the body of the boy Samuel was found among the rubbish on the ground floor dreadfully burned; the daughter expired shortly after in the London Hospital. On the Monday following, Mr. Baker held an inquest on the two unfortunate sufferers, when the jury returned a verdict "that the deceased died from burns received at the house, No. 45, Whitechapel-road, but how the house caught fire there is no evidence to show."

Thursday, September 28, 8¼ A.M. The "Angel and Trumpet" public-house, No. 23, King-street, Bloomsbury. The alarm of "fire," was speedily responded to by the arrival of Conductor Chapman with the Royal Society's fire-escape from Hart-street. Upon his reaching the spot he found the lower part of the house in flames, and all communication by the stairs cut off, the inmates, six in number, were collected at the first-floor window, and the police were entreating them to wait the arrival of the fire-escape; with the aid of the police the conductor brought them all down safely. Engines from the Parish, Brigade, and West of England stations hastened to the spot, and the fire was speedily extinguished, but not until the bar-parlour was burned out, and the stock, utensils, and bar fittings very seriously damaged.

Monday, October 2, 2½ A.M. Vault beneath the Wesleyan Chapel, Liverpool-road, Islington, used as a broker's store. The Islington engine was quickly on the spot, and a plentiful supply of water obtained from the New River mains. A gallant effort was made by Mr. Brown (the engine-keeper) to enter the vault and attack the fire at close quarters, but the flames having penetrated through the floor above, seized the chapel fittings, and ran through the whole building like wildfire. The Brigade, West of England, and County engines rapidly reached the spot, and torrents of water were poured into the chapel, but without avail, the flames raging until nothing but the bare walls remained. So intense was the heat thrown out by the burning mass, that the adjacent buildings were for a long time in imminent peril, and were only saved from destruction by the exertions of the firemen, some of whose clothes were burned to pieces, and some of the fire-engines severely scorched. While the firemen were thus busily engaged, intelli-

fence arrived of a serious fire which broke out at 3½ A.M., in the well-known Shooting Gallery, 417, Strand, and was not extinguished until the premises had been almost destroyed.

Saturday, October 28, 1½ A.M. Camberwell was again the scene of another destructive conflagration, which commenced in the lower part of a house occupied as the offices of Mr. Fleming's brewery. Almost as soon as discovered, the fire communicated to the brewery and to several adjoining buildings. Engines from the stations of the Brigade, West of England, and County Fire Offices reached the spot as quickly as the distance would permit; but, unfortunately, the supply of water afforded by the Vauxhall main was wholly inadequate to the requirements of the occasion, and the fire could not be mastered until the brewery and two adjoining buildings were burned to the ground. The granary and stable of Mr. Branch were also destroyed, and two horses burned to death, and several other premises very severely damaged.

Thursday, November 30, 11¾ P.M. Mr. Powell, optician, No. 112, Gray's-inn-lane. The moment the fire was discovered, an alarm was given, and the street door broken open, when five persons (lodgers) rushed out in their night clothes. Mrs. Powell was at work in the first floor front room, and on discovering the fire raging below, she ran to the back room, where her children were sleeping, and put them out of the window, being assisted by a lodger's daughter, named Cullen, who behaved most heroically. The second floor back room was occupied by a young married couple, named Thackeray; on the first alarm of fire, the husband escaped into the street, but not seeing his wife, he returned to his room to try to save her. The building, which was very old, consisted of front and back rooms, with a square well staircase between, enclosed by brick walls; the flames having seized the staircase, cut off all communication. On regaining his room, poor Thackeray found escape impossible, and precipitating himself out of window, he fell into the enclosed yard at the rear of the premises. The Royal Society's escapes from Hatton Garden and Bedford-row were promptly brought to the spot by Conductors Sunshine and Christianson, who were told a child remained in the third floor front room: on searching the room, which was partly in flames, it was found void of inmates, and the conductors were then directed to the roof, but with no better success. Conductor Eyles, from Bridge-street, Blackfriars, having arrived, he proceeded to the back of the burning premises, where he found Mr. Thackeray lying in the yard, and his clothes burning. Eyles having thrown himself into the yard, called for a rope, which being lowered, he made it fast to Thackeray's legs, and he was drawn up through a narrow window of an adjoining house, and taken to King's College Hospital, where he shortly after expired, having fractured the base of the skull. The Brigade and West of England engines were promptly in attendance, and the fire extinguished. On entering the second floor back room, the firemen found the body of Mrs. Thackeray lying on the floor, suffocated; but not much burned. Inquests were held upon the bodies by Mr. Mills and Mr. Bedford, and terminated in verdicts of "accidental death." At both, great praise was given to the fire-escape conductors for their exertions. A large sum of money was ultimately subscribed for the benefit of the poor persons who lost their all in the fire, and for rewarding the girl, Cullen, and fire-escape conductor, Eyles, to whom £5 was awarded for his meritorious exertions.

Friday, December 15, ¾ A.M. The cellar of No. 3, Ruffords'-buildings, High-street, Islington, occupied by Mr. Heeks, basket-maker. The rest of the building was in the occupation of Mr. Brown, coffee shop keeper, who, with his wife and three children were sleeping in the second floor. A vast body of smoke rolling up the stairs prevented their escape. On alarm being given, Conductor Wilson, with the St. John-street escape, closely followed by Conductor Short, with the escape from Islington-green, were on the spot remarkably quick; finding the fire ascending, and several persons at the second floor window, the conductor raised his escape, and brought down five persons in safety, consisting of Mr. and Mrs. Brown and their three children, Mrs. Brown being in an insensible state.

The prompt arrival of Mr. Brown with the Islington engine, and its judicious application, confined the flames to the cellar.

Wednesday, December 27, 3½ A.M. Mr. Quinn, carpenter, No. 3, Tennis-court, Middle-row, Holborn. The fire broke out among a quantity of shavings, the heat and smoke from which prevented the escape of the inmates. Conductor Christianson, with the Bedford-row escape, upon his arrival, having found the cellar on fire, took the short ladder, and entered the first floor back room, which, having searched, he then, amid much smoke, ascended the second floor, and finally discovered two persons in bed, nearly suffocated; assisted in getting them out of the window, and with the aid of Conductor Sunshine, who also attended with the Hatton-garden escape, brought a third person out, (a female much intoxicated,) who was quite unable to have escaped without such assistance. The prompt attendance of the Brigade engines from Farringdon-street, and Holborn stations, happily arrested the progress of the fire, which, from the closeness of the locality, at one time led to serious apprehensions of extensive mischief.

The daily distribution of the fires reported during the past year has been as follows:

Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.
113	123	95	120	124	111	119

Their distribution throughout the day and night has been in the following proportions:

	First hour.	Second hour.	Third hour.	Fourth hour.	Fifth hour.	Sixth hour.	Seventh hour.	Eighth hour.	Ninth hour.	Tenth hour.	Eleventh hour.	Twelfth hour.
A.M.	52	51	44	24	26	15	11	16	9	8	23	19
P. M.	20	18	22	27	30	38	36	65	71	64	62	54

The following list shows the occupancy of the premises, with reference to those portions of them in which the fire originated; thereby illustrating the comparative liability to accident by fire of various trades and manufactures, as compared with private dwellings :

Occupation.	Totally Destroyed.	Seriously Damaged.	Slightly Damaged.	Total.
Apothecaries	..	1	6	7
Bakers	1	3	13	17
Basket-makers	..	1	..	1
Beershops	..	8	11	19
Booksellers, Binders, and Stationers	..	3	7	10
Brewers	1	..	1	2
Brokers and Clothes Salesmen	..	9	3	12
Brickmakers	..	1	..	1
Builders	1	4	3	8
Cabinet-makers	..	10	7	17
Cane Dyers	..	1	..	1
Carpenters and Workers in Wood	2	15	18	35
Cart Grease-maker	..	..	1	1
Chandlers	..	7	12	19
Chemical Laboratory	..	..	1	1
Chicory Roaster	1	..	..	1
Churches and Chapels	2	..	3	5
Coach-makers	1	1	1	3
Coals and Coke, Dealers in	1	..	1	2
Cocoa-nut Fibre Manufacturer	..	1	..	1
Coffee-shops and Chop-houses	1	4	6	11
Coopers	..	..	1	1
Cork-cutter	..	1	..	1
Corn Chandler	..	1	1	2
Curriers and Leather-dressers	..	3	4	7
Drapers, Hosiers, and Mercers	2	9	14	25
Druggists, wholesale	..	1	..	1
Eating Houses	..	1	8	9
Engineers and Machinists	..	2	..	2
Farming Stock	..	4	..	4
Feather-dresser	..	1	..	1
Felt-monger	..	1	..	1
Firework-maker	..	1	..	1
Flax-dresser	1	..	..	1
Floor-cloth Manufacturer	1	..	..	1
Furriers and Skin Dyers	..	4	1	5
Gas Works	..	1	1	2
Glass-blowers	..	2	1	3
Glue-makers	..	1	..	1
Grocers	2	6	3	11
Hat Manufacturers	..	5	1	6
Horse-hair Merchant	..	1	..	1
Hotels and Club-houses	..	1	2	3
Japanners	..	1	..	1
Lamp-black Maker	..	1	..	1

Occupation.	Totally Destroyed.	Seriously Damaged.	Slightly Damaged.	Total.
Laundresses	..	..	5	5
Lucifer Match-makers	..	1	3	4
Marine Stores, Dealer in	..	2	4	6
Mattress-maker	..	1	..	1
Mills, Steam Flour	..	2	..	2
Musical Instrument-makers	..	5	..	5
Mustard Manufacturer	..	1	1	2
Oil and Colourmen	..	8	5	13
Paper-stainers	..	..	1	1
Pastrycooks and Confectioners	..	..	3	3
Pawnbrokers	..	1	..	1
Plumbers, Painters, and Glaziers	..	3	..	3
Printers, Letter-press	..	2	1	3
Ditto, Copper-plate	..	1	..	1
Private Dwellings	1	53	225	279
Public Buildings	..	1	3	4
Public Places of Resort, not Theatres	..	..	4	4
Rag Merchants	..	..	1	1
Railways	..	2	3	5
Sailmakers	1	..	..	1
Sale Shops and Offices	3	19	30	52
Sackmakers	..	..	1	1
Saw-mills, Steam	..	..	2	2
Scum-boilers	..	..	1	1
Ships	..	3	4	7
Ship-builders	..	1	1	2
Ship Chandlers	..	1	..	1
Soot Merchant	..	..	1	1
Stables	..	6	8	14
Starch Manufacturer	..	1	..	1
Straw-bonnet Makers	..	2	..	2
Sugar Refiners	..	1	..	1
Tailors	..	1	4	5
Tallow Chandlers and Melters	..	1	3	4
Tanners	..	1	1	2
Tarpaulin Manufacturers	..	1	1	2
Theatre	..	..	1	1
Timber Merchants	..	..	1	1
Tinmen, Braziers, and Smiths	..	..	3	3
Tobacconists	..	6	6	12
Under Repair, or Building	1	1	8	10
Unoccupied	..	1	5	6
Upholsterers	1	..	1	2
Varnish Manufacturers	..	1	..	1
Victuallers, Licensed	2	16	24	42
Wadding Manufacturers	..	1	..	1
Warehousemen, Manchester	..	2	4	6
Ditto, Foreign Fancy	..	1	1	2
Weavers	1	..	..	1

Occupations.	Totally Destroyed.	Seriously Damaged.	Slightly Damaged.	Total.
Weavers, Wire	..	..	1	1
Wine and Spirit Merchants..........	...	..	6	6
Workshops, no Hazardous Goods or Processes	..	2	1	3
Total..........	27	269	509	805

The causes of fire, as far as they could be satisfactorily ascertained, appear to have been as follows:

Accidents of various kinds, for the most part unforeseen, and unavoidable ..	5
Apparel, ignited on the person	7
Bleaching straw	1
Candles, various accidents with	125
———, ignited bed curtains	61
——————— window curtains	51
Carelessness, palpable instances of....	22
Charcoal fires	2
Chemical experiments..............	2
Children playing with fire	9
——————————— candles	3
——————————— lucifer matches.	7
Cinders put away hot	5
Coppers improperly set	2
Dog, and cat, upset linen, &c........	2
Drunkenness	3
Fire sparks	63
Fireworks, selling of	1
Flues, defective and overheated	27
——————————— in next house	6
——, blocked up..................	6
——, foul, ignited	17
Friction of machinery..............	2
Fumigation, incautious	4
Furnaces	16
Fusees ignited by heat of the sun	1
——————— friction in drawer ...	1
——————— dropped down area..	1
Gas, escape of from defective fittings...	39
—, accidents in lighting............	7
—, left burning too high	15
—, fittings, repairing..............	3
—, stove........................	1
Hearths, defective	4
———, fires kindled upon	4
Japan, boiling of..................	1
Lamps, oil	2
———, naphtha	1
Lightning........................	1
Lime, slaking	5
Linen, drying or airing before fire....	36
Lucifer matches, making of	4
———————, using............	13
———————, ignited by friction in drawer	8
Ovens, overheated	2
Pitch, tar, and tallow, boiling of	10
Sealing-wax, making of	1
Sewing in bed	1
Shavings, loose, ignited............	27
Soot put away hot	1
Spirits thrown on fire, in mistake, for water..........................	1
Spontaneous ignition of lamp black ..	2
——————————— of greasy rags ...	3
——————————— of sawdust and oil	1
——————————— of signal lights ..	1
Steam boiler, heat of	1
Stoves, defective and overheated......	23
——————————— in next house	4
——, improperly set..............	9
——, drying	6
——, pipe......................	4
——, ironing....................	1
——, muffin....................	1
Suspicious	11
Tobacco, unextinguished............	37
Turpentine, various accidents with ...	4
Wilful	25
	767
Unknown	38
	805

From the foregoing it will be seen that "the safest of all lights," GAS, has been productive of considerable mischief. In addition to the fatal accident in Albany-street, which I have fully noticed, numerous other explosions, attended with considerable personal injury, and the destruction of much property, have occurred within the last twelve months in the metropolis. As gas-fittings become dilapidated by age, great attention is required to guard against the occurrences of accident: unfortunately, however, we find quite as many accidents take place with *new* fittings as with *old*. There is no rule without an exception, and some gas-fitters are very intelligent, well-informed men, but the majority of them are very far below the mark. At a recent

inquest, after a fatal fire, a shop-keeper stated, that gas escaped through a screw-hole in the counter; upon sending for his gas-fitter, he said, "Oh, put a bit o' putty into it!" The consequence of the *puttying process* appears to have been, that the gas, which escaped *from the pipe*, being no longer able to get up through the counter, accumulated beneath, and being ignited by a light taken into the shop by a child, caused the destruction of the premises and the death of two persons.

The culpable practice of throwing about the unextinguished remains of cigars, tobacco, and the fusees now so much used for lighting them, has been productive of very great annoyance; on several occasions it has led to the destruction of much valuable property, involving in one case a loss of life, and placing many more lives in jeopardy.

The most lamentable circumstance, however, which stands conspicuous in the causes of fire, is the large number which are known to have been *wilfully* occasioned, for the purpose of defrauding the insurance companies. It is a very common occurrence for individuals to endeavour to turn an accidental fire to the best account, by making an excessive claim upon the insurers; but unfortunately too many persons cannot wait for a *god-send* of this sort, and find themselves under the necessity of "helping themselves" by a "flare-up." When a large showy concern, (furniture-mart, for instance,) filled with trashy and worthless stock, fails to make a satisfactory return, it is consigned to the Insurance Company at a large figure, which is no sooner done (the policy often undelivered) than somehow or other a fire breaks out, without any apparent cause, *on every floor at once*, and notwithstanding every thing has been well wetted (with *turpentine*) the whole is consumed.

The immunity with which this crime is perpetrated, renders it of frequent and increasing occurrence. If the case is a very gross one, and the proofs palpable and convincing, the Insurance Company may refuse payment, but it must be a very clear case indeed upon which they venture into Court. If the matter will not do to be left to "the glorious uncertainty of the law," a compromise is effected; a claim of 600*l.* being met by an offer to pay 150*l.*,—or a claim of 200*l.* by an offer of 30*l.*; both of which sums I have known to have been gladly taken!

For the crime of *arson*, even when accompanied by *murder*, there is NO PROSECUTOR. Mr. Payne, the coroner, who has been most indefatigable in holding courts of inquiry into all the cases of suspicious fires within his district, recently made a public complaint of this state of things, remarking "that it was of little use for him to take the pains of investigating a case and detecting the guilty party, if there were no person to prosecute afterwards." Mr. Payne complained, that he was not supported by the *Insurance Companies*; but I think a little reflection would convince the worthy coroner that there are many reasons why the Insurance Companies cannot take upon themselves the office of *public prosecutor* in case of *arson*. In a *civil action*, it is admitted on both sides to be a question of £ *s. d.*; but in a *criminal court*, a prosecution upon *moral* grounds would, in nine cases out of ten, be attributed to *pecuniary motives* by a clever "counsel for the defendant," and justice be defeated. Mr. Payne's remarks upon the occasion referred to being seen by a public-spirited magistrate,* he took upon himself to order the police to arrest and prosecute the offenders. And thus it ought to be in all cases. If I go into a house, and *poison* or *cut the throats* of five individuals, all the machinery of police is in the most active requisition; but if, (as in a recent case,) I set fire to the house, and suffocate or burn the inmates, *no notice is taken of the matter!*

Recent occurrences demonstrate the necessity for some legislative enactment, by which this defect in our laws may be remedied.

The number of chimneys on fire recorded in these reports forms but a very small portion of those which have been attended by the firemen; only those, in fact, which were represented as "houses on fire," and caused a turn out of a number of men and engines, suited to that contingency. But even the whole number attended by the firemen do not form a tithe of the total, such accidents being fully as frequent as ever: they are, however, less mischievous in their consequences than heretofore, arising in a

* Mr. Cottingham.

great measure, no doubt, from the better construction and *uninjured state* of our chimneys. When fires do occur in chimneys, it invariably turns out that it is not attributable to imperfect cleansing, or to the circumstance of any inability in any particular machine to effect the cleansing, but solely to the fact that *cleansing has been entirely neglected.*

In spite of the tardy interference of the legislature, which has been granted to the unwearied importunities of a few benevolent individuals, the *climbing system* is not yet extinct. A fellow named Watts may be seen prowling about the parishes of St. Luke's, Clerkenwell, and Islington, followed by a poor, emaciated child, apparently not more than ten or eleven years of age, who is made to climb the chimney of any person brutal enough to require it. Perhaps housekeepers are not aware of the penalty to which this practice makes them liable; for their information, therefore, I beg to observe, that, by the Act 3rd and 4th Vict., c. 85, it was enacted that "from and after the first day of July, 1842, any person who shall *compel*, or *knowingly allow* any child or young person, under the age of twenty-one years, to ascend or descend a chimney, or enter a flue, for the purpose of sweeping, cleaning, or coring the same, or for extinguishing fire therein, shall be liable to a penalty of not more than ten pounds, or less than five pounds." One half of which penalty, costs, and charges, is to be paid to the informer, the other half to the poor of the parish.

At a coroner's inquest, held in the Board-room of the Holborn Union, on the 2nd of Dec. last, Mr. Mills, the deputy coroner, asked Mr. Braidwood if it was true that the parochial authorities of St. Andrew's, Holborn, had refused to pay the parliamentary rewards to the firemen, for early attendance with their engines at fires in that parish? Mr. Braidwood said they had for some time so refused. Several of the jury expressed themselves most indignant at the conduct of the authorities, and said it was not the wish of the inhabitants that the rewards should be withheld. Proceedings have since been instituted on behalf of the firemen, and a most important question raised, the nature of which will be understood by the following extract from the *Morning Chronicle* of Jan. 25th, 1849, being an account of the proceedings in the

BAIL COURT,

[Sittings in Banco, before Mr. Justice Erle.]

EX PARTE LODER.

Mr. Huddlestone, in the case of Thomas Loder, a member of the Fire-brigade, applied for a rule calling upon Boyce Combe, Esq., one of the metropolitan magistrates, and Messrs. Price and Sweeney, churchwardens for the parish of St. Andrews, Holborn, to show cause why he (Mr. Combe, the magistrate) should not give his approbation and consent to payment being made by the churchwardens of the sum of 20s., or such other sum as his worship might fix, to the said Loder, for having, as engine-keeper, brought the second engine, which endeavoured to extinguish a fire at the house of Mr. Powel, 112, Gray's-inn-lane, on the 30th of November last. The present application was made upon the authority of the 11th and 12th Vic., cap. 44; the 5th section of which empowered the Court of Queen's Bench to compel the magistrate, in case of his refusal, to order the money to be paid which he might think the claimant entitled to under the circumstances. The affidavit set forth the facts of the fire having taken place at the time mentioned, and of Loder being the keeper of the second engine that had arrived. On the 8th of January, Loder had applied for a summons to Mr. Combe, which was granted. It came on for hearing on the 10th of the same month, when it was adjourned. On the 16th of January it was again called on, when the churchwardens appeared to oppose the claim. Mr. Combe declined to mention any sum of money to which the plantiff was entitled, delivering his judgment in writing, to the effect that, in his opinion, the magistrates had no right to interfere, except upon the application of the churchwardens; and in order that the party might have an opportunity of taking the opinion of the Court of Queen's Bench upon the subject, he decided against such an application, unless the churchwardens had made it. The application to the magistrate had been made under the provisions of the 14th Geo. III., c. 78, which was called the Building Act. The 76th section, after enacting what reward ought to be paid to the turncock on the occasion of a fire, stated that the engine-keeper who brought the first parish engine in complete order should be paid a sum of money not exceeding 30s., and he who brought the second engine should be entitled to a sum not exceeding 20s., such payments to be made by the churchwardens or the parish; and in default of payment thereof, such reward to be levied and recovered from the churchwardens or overseers by distress and the sale of their goods. The 77th section provided, that no reward shall be applied for without the approbation of an alderman of the city, or a justice of the peace. The important question, then, to be decided was, whether the churchwardens or overseers, were to be the parties to put the magistrate in motion, or whether the magistrate had not himself the power of adjudicating the amount to be paid under the circumstances, upon the application of the claimant.

Mr. Justice Erle was of opinion that the act empowered the magistrate to award the sum to be paid. It would be most anomalous that the party who would have to pay should have the power of deciding the amount. There was quite enough shown for a rule *nisi*.

Application granted.

On the 30th January the matter again came before the Court, when Lord Denman said the Court was of opinion on the general question, that the magistrate was bound to exercise a discretion, and to declare his opinion on the application.

Mr. Justice Coleridge: By the statute, the person who came first, second, or third with an engine, in a proper state, was absolutely entitled to some

reward. The parish officers were to be the hands to pay it. The act contemplated that, perhaps, if left to themselves, they might pay too largely and carelessly, under the notion that they might indemnify themselves out of the rates; and, therefore, in protection of the parish, and in restraint of the discretion of the churchwardens, it enacted that they should not pay without the consent of the magistrate. They might be summoned before him for that purpose. Here the parties went before the magistrate, and the title of the claimant being fully made out, the magistrate was entitled to make the order upon them.

Mr. Justice Wightman said that the difficulty of the magistrate appeared to have arisen on the question of who should fix the amount. The claimant was entitled to something.

After some discussion as to whether and how the overseers and churchwardens could reimburse themselves, and, after an intimation from the Court that if they were not reimbursed out of the rates, they might make a special rate under the 14 Geo. III., *the Rule was made absolute.*

I have, on several previous occasions, commented upon the arbitrary and inconsistent manner in which this law has been administered. "The *fire-rewards*," as Sir Chapman Marshall recently most justly observed, "are not given as *wages for labour performed*, but as *encouragements* to the men *to hasten to a fire* on the first alarm." They are rewards for promptitude in attendance, and by the very nature of the case, are sure to fall to the lot of the most deserving; they might very properly be withheld when the *bringing* of an engine is not followed by its useful application when its services were required, although the law makes no stipulation on this point. The question raised through the illiberality and obstinacy of the St. Andrew's authorities was a most important one; let us hope it is now, after being so fully discussed, finally settled until a new Bill is brought into Parliament more adapted to our present circumstances than that of the 14th Geo. III., which has long been a dead letter on the statute-book, and of which this is the only portion not yet repealed.

Shortly after the destructive fire at Messrs. Bradbury and Co.'s, Manchester warehousemen, in Aldermanbury, which entailed a heavy loss upon the insurers, (*Vide* Fire Report for 1845, vol. xliv., p. 214,) it was agreed by the principal Fire-offices to advance the premiums upon Manchester and other warehouses, increasing the rates with increase of dimensions, &c. The tariff thus arbitrarily established was generally considered to be excessive, and so much beyond what the actual character of these risks warranted, that it gave rise to great dissatisfaction. The present greatly diminished, and daily diminishing amount of loss, by fire, in the metropolis, taken in connection with the higher rates so injudiciously imposed, brought a number of new fire-offices into the field, which, being no parties to the obnoxious tariff, found prompt and extensive support. Of these, the *Legal and Commercial*, which was started by the Manchester warehousemen in self-defence, has been most successful. The *Star*, and more recently the *National Mercantile*, have made great progress in public favour. There are at this time fourteen fire-offices doing business in London which have not adopted the new tariff.* The effect of this competition has been so severely felt, that at a meeting of the monopolising offices, on which the *Sun* shone in *November last*, it was resolved—"That the rates adopted on 29th November, 1845, for large linen-drapers' shops in London and several towns in Ireland be abandoned, and that each office be at liberty to charge such rates for these risks as may be thought expedient."

It is to be regretted that in this, as in every other case of reaction, there is a tendency to extremes; there is evidently a disposition to *excessive competition*, and several very heavy insurances have recently been taken by some of the younger offices, at rates, which, if the doctrine of probabilities holds good, are likely to prove very disastrous. As far as the public are concerned, however, there is but little cause for fear, as no one office, not even the largest and most substantial, will hold above a certain portion of any particular risk; the constant practice is to get portions of all heavy risks guaranteed by other offices, so that, in the event of accident, the whole loss is divided among so many concerns as not to be severely felt by any. This system of subdividing losses is well understood and very extensively practised by insurers.

The vicinities of Bedford, Faversham, Hertford, Lamarsh, Lee, Nottingham, Reading, Rugby, and other places, have, during the last year, been outraged by the prevalence of *incendiarism*. The public spirit displayed by Lord Thurlow in protecting the district around his lordship's estates in Suffolk, has put

* Not one of which has any firemen or engines.

a stop to the evil in that neighbourhood. His lordship has recently added a *fourth* fire-engine to his establishment, marked, "*Lord Thurlow's Brigade, section D.*" This elegant machine has been built by Mr. Merryweather, of Long Acre, as light as possible, to be drawn at great speed by his lordship's own carriage-horses: it is of the description formerly known as "Simpkin's Patent *Dwarf-engine,*" consisting of two large working-barrels in a single casting, with a short stroke, capable of delivering a ¾in. jet, upwards of 90 feet high, with from sixteen to twenty men. In a paper by Mr. Braidwood, read at the Institution of Civil Engineers, it is stated that a brigade fire-engine, with 7in. barrels, delivering a ¾in. jet, with its hose and tools, (12ft. suction-hose, and 240ft. delivery-hose,) weighs 21½cwt. The success of Mr. Merryweather's endeavours, therefore, to combine *power* and completeness with *lightness*, will be apparent, when it is stated, that the whole weight of Lord Thurlow's engine, with all its tools and appurtenances, including 30 feet of Hancock's patent caoutchouc suction-hose, and 500 feet of Vaucher's patent canvas delivery-hose, does not exceed 14 cwt.!

Many country gentlemen may desire to protect themselves and neighbours against incendiary or accidental fires who have not the means of doing so on a large scale; to such persons the "Farmer's Fire-engine" affords most conveniently, and at a small expense, the required means of security. A writer in the *Farmer's Magazine* for December last, observes, that "it too frequently happens, on the breaking out of a fire in agricultural districts, that the inhabitants become painfully cognisant of the fact, that the nearest *fire-engine* is some fifteen or twenty miles distant; and even this, when obtained, too often disappoints their hopes, by proving in a miserably inefficient state. We are led to ask, then, to what must we attribute this lamentable state of things? Partly, perhaps, to supineness on the part of those who, having for years enjoyed an immunity from the visitations of fire, have become apathetic; but in a great measure it may be attributed to the circumstance that *fire-engines*, as heretofore constructed, have been too costly in their purchase, and required too much care and attention to keep them in working order, to come within the means of a small country parish, containing as it often does, less than half a dozen farms.

"Now Mr. Baddeley's 'Farmer's Fire-

engine'* is a decidedly agricultural implement, and promises adequately to supply this long-felt desideratum. The above machine is so exceedingly portable as to be easily conveyed from place to place by one man, and is so simple in its construction that any person at a glance can understand and manage it. All the parts are so constructed and arranged as to be fitted for the roughest work of a farm without any fear of injury. The valves are of metal, and not liable to derangement; but should any obstruction occur, it can be removed instantly,

* Described in *Mech. Mag.*, vol. xlvii., p. 300.

without disturbing any of the working parts of the engine. To country villages, and to gentlemen whose establishments do not require or warrant the maintenance of a more powerful fire-engine, it offers much security and convenience, as well for extinguishing fire as for watering lawns and gardens, filling cisterns, &c."

The Editor of the *Bury Post* thus concludes a commendatory notice of this engine: "Everybody knows the importance of *time* in the extinguishing of fires, and that many a calamitous conflagration might have been reduced to an insignificant loss, had a fire-engine been at hand at the moment of discovery. The price of this engine brings it within the reach of every considerable occupier, and as it may also be available for agricultural uses, as well as for extinguishing fires, we should think that in a district, afflicted as ours has been, almost every farmyard would be furnished with it."

THE LONDON FIRE ESTABLISHMENT, under Mr. Superintendent Braidwood, and the district foremen, Messrs. Fogo, Colf, Staples, and Henderson, continues to afford ample protection to this extensive metropolis, and, by prompt assiduity, to allay the well-grounded apprehensions of the inhabitants of many a fire-menaced locality. Want of space alone prevents my naming many occasions during the past year where their exertions elicited universal commendation.

THE WEST OF ENGLAND firemen, under Mr. Connorton, have maintained, in all its integrity, their well-established character for promptness of attendance and judicious exertion. In July last, the company furnished their London establishment with a splendid new fire-engine,* which for power, completeness, and efficiency has but few rivals. This engine stands A1 in the metropolis, and is every way worthy of those by whom it is so well handled. Most parts of the metropolis have witnessed the spirited exertions of this unique corps, at present the only rivals left the *Brigade* in London; the *County* fire office having temporarily suspended their fire establishment at the close of the year.

THE ROYAL SOCIETY FOR THE PROTECTION OF LIFE FROM FIRE have published a short account of "Cases of Lives Saved,"† from which it is evident that, during the past year, the Society has proved of great usefulness.

The uniform success of the Society's servants induced the parish authorities of St. George's, Southwark, early in 1848, to enter into an arrangement for placing two fire-escapes in that populous parish. One was accordingly placed at St. George's Church, in the Borough—another at the Obelisk, in the Blackfriars-road.

The latter station, in compliance with a requisition most numerously and respectably signed by the subscribers, has been furnished with a new and improved fire-escape, invented and constructed by Mr. David Davies, carriage builder to the Great Western Railway, but better known as the inventor of the Basterna, Pilentum, and other fashionable carriages, as well as the patentee of various important improvements in carriage architecture. This fire-escape (the third invented by Mr. Davies*) is exhibited in the engraving, page 248, which has been kindly lent me for this occasion by the proprietor of the *London Illustrated News*. The escape consists of a main ladder, mounted on a light and easily-managed travelling carriage; the ladder is most ingeniously trussed on the under side with wire ropes, so as to combine great strength and stability with lightness.

A capacious balcony slides up and down the main ladder by means of a small windlass worked by winch handles on both sides of the carriage. The descent of the balcony may be controlled by a lever-break, and the balcony comes down upon two massive buffers of vulcanized India-rubber, to guard against the possibility of accident. The main ladder and balcony is especially adapted for second floors, and is provided with a supplementary ladder for first floors, or when fixed in the balcony, it commands the third floor and roof of a building. A folding lever and step-ladder combined, at the lower part of the carriage, furnishes a convenient descent from the balcony, and also the means of propelling and guiding the machine as it travels in an erect position. This excellent machine first came into actual use in August last, and saved the lives of Mr. Clare and family, as before stated.

* This is an addition to several recently provided in some of the principal provincial towns.

† To be had gratis at 169, Fleet-street.

* Described in *Mechanics' Magazine*, vol. xi., p. 101; and vol. xxiii., p. 114.

The following is a Summary of Fires attended, and Human Lives Saved, by means of the Society's Fire Escapes and Conductors, since its Re-establishment in 1843.

Year		Number of Stations.					Fires attended.		Lives saved.
1844	..	9	increased during year to		11	..	68	..	9
1845	..	11	„	„	15	..	82	..	8
1846	..	15	„	„	21	..	160	..	12
1847	..	21	„	„	24	..	198	..	12
1848	..	24	„	„	26	..	213	..	27

The Society's conductors do not undertake the extinguishing of fires, nor are they provided with any apparatus for that purpose. On reaching a fire, however, and finding no lives in danger, they always endeavour to render themselves useful; and have, on several occasions, succeeded in arresting the progress of the flames, or keeping them in check until the arrival of the firemen. The above summary furnishes undeniable evidence of the great importance and utility of the Society.

The Society for the Protection of Life from Fire is wholly dependent upon parochial* and private voluntary subscriptions, Her Most Gracious Majesty the Queen being the patron and largest benefactor. The affairs of the Society are managed, and the accounts audited by the subscribers; it has no expensive "staff," but the whole of its funds are devoted to the legitimate object of the Society, viz., the maintaining, at distances of half a mile from each other, "Fire Escape Stations" throughout London, each attended by a well disciplined conductor; and rewarding all persons saving life from fire.

29, Alfred-street, Islington, March 1, 1849.

* Parochial contributions are voted under the Statute of 14 George III., cap. 78; the sufficiency of which for the purpose is thus decided upon by Mr. Auditor Gibbs:

". . . . Considering the extent of public benefit which will accrue by a liberal interpretation of the statute in this behalf, I am inclined to allow, as an extra charge on the poor-rates of each parish, for fire expenses, such competent sum of money as may be deemed, by the majority of vestrymen, duly assembled, requisite for the ends aforesaid; the order of vestry to pay, and the receipt for the amount paid, will be the voucher I shall require at the audit."—*Vide Letter to the City Treasurer.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING FRIDAY, MARCH 16.

ROBERT WALTER WINFIELD, Birmingham, merchant and manufacturer, and JOHN WARD, Birmingham, workman in the employ of R. W. Winfield. *For certain improvements in the manufacture of tubes, and in certain articles made in part of tubes.* Patent dated September 14, 1848.

These improvements refer—

1. To the manufacture of tapering tubes from any metal or alloy of metal; and

2. To the manufacture of brass tubes for gas fittings.

1. A sheet of any suitable metal, or alloy of metal, is bent and soldered on a mandril of the requisite form, and is drawn by the ordinary apparatus employed for the like purpose through a ring or mould, which has a hole in the centre, of the size which it is desired to give the first part of the tube. This ring or mould is composed of any soft metal, such as tin, so that as the rough pipe upon the mandril is drawn through, it will yield like an expanding draw-plate, and yet, at the same time, press the pipe into contact with the mandril. The form of the ring and mandril may be varied according to the shape the tube is required to have, whether flat-sided, circular, or grooved. When it is desired to give a twisted form to the tube, rotary motion is communicated to the ring or to the mandril. By using two or more rings, and varying their thickness, any form may, it is stated, be given to the tube with great exactitude.

2. The improvements in gas fittings consist in making two brass tubes separately, and placing them, one inside the other, upon a mandril, and passing them through a draw-plate, to bring them into close contact, whereby great stability is given to the fitting, and any leakage of gas prevented.

Claims.—1. The manufacturing of taper tubes of metal by pressing a roughly formed tube into close contact with a mandril supported inside it, which pressure is effected by drawing it through rings or moulds of soft metal, or other yielding material, which will yield or expand as the tube is drawn through it, and yet exert sufficient pressure to keep the tube in contact with the mandril, whatever be the form given to the mandril, or the rings, or the materials employed.

2. The manufacture of gas fittings of double brass tubes.

WILLIAM DICKINSON, Blackburn, Lancashire, machine maker. *For certain im-*

provements in, and applicable to, looms for weaving. Patent dated September 11, 1849.

Claims.—1. A combination and arrangement of parts by which, when the weft thread is broken or exhausted, the loom is stopped working by a sliding catch-box, which causes, through the intervention of suitable gearing, the driving band to traverse from the fast to the loose pulley, and which catch-box is actuated by a vibratory lever, worked by means of a combination of rods and levers from the treddles or pricking-bars.

2. An arrangement of apparatus by which the reed is maintained in its place when the slay beats up and the shuttle does its duty; but by which, when the shuttle traps or remains in the shed, the reed is made to swivel in the slay cap, and thereby to prevent the injury which would ensue from the reed striking the shuttle up against the temple.

3. An arrangement for applying the break to the fly-wheel simultaneously with the stoppage of the loom.

4. A mode of extending the reed by means of the slips.

WILLIAM SAGER, Rochdale, wooldealer. *For certain improved means and apparatus for effecting the transit or conveyance of goods, passengers, and correspondence, by land or water, and for other such purposes; part or parts of which constitute a new and improved method of generating steam, which improvement is applicable to other purposes to which steam is generally applied as a motive power.* Patent dated September 15, 1848.

1. The patentee first describes an improved STEAM GENERATOR. It is constructed with three rows of fire bars, one above the other, and with sufficient space between the rows to contain a number of oval or elliptical vessels, fixed longitudinally, and closed at the ends by flanges or other suitable means. Between every two of these vessels there is placed a smaller vessel of the same shape, and above each of the larger vessels there is a square-shaped one with a concave bottom. Through the centre of each of the three different sets of vessels there passes a feed pipe, which is perforated on the under half of its circumference, whereby the water is maintained at a fixed level by a force pump. Or the water may be injected through the perforations of the feed pipes upon the heated surfaces of the vessels. The lower half of the large, and the whole of the small, elliptical vessels are imbedded in the fuel—the latter having their sides above the water line protected from burning by suitable covers. Horizontal iron plates, stretching from end to end, are fixed to the sides of the square vessels, and have the effect of confining the heated air and smoke, and causing them to pass over the top surfaces of the large elliptical vessels and through the flues in the square-shaped ones. In the upper part of each vessel, and considerably above the water line, there is a pipe which conducts the steam directly to the cylinders or to a steam chamber. This apparatus carries at the top a water vessel, which extends its whole length, and is concaved on its under surface; and it has a flue through which the heat and products of combustion escape to the chimney. It is also furnished on each side with vertical reservoirs in which the feed water is contained and partially heated before passing to the steam generators; and it is provided with doors for introducing the fuel, and with dampers for regulating the admission of atmospheric air. The feed and steam pipes are fitted with stop-cocks, and each vessel with water gauges and safety-valves.

2. We are next presented with an IMPROVED LOCOMOTIVE, which consists of a frame fitted with two running wheels, and a driving wheel composed of four parts. The inner halves of the peripheries of the two inside parts are straight, and the outside halves, as well as the peripheries of the other two parts, are bevelled off outwards. The driving wheel is keyed upon a transverse shaft, having cranks at each end, to which the piston rods of two horizontal steam cylinders are attached. These steam cylinders are connected by iron bands, and are fixed, together with the transverse shaft, upon a longitudinal shaft, which is supported in bearings in the frame, and furnished with a handle by which it may be made to turn. As long as the longitudinal shaft remains in the first position, that is to say, as long as the cylinders are in a horizontal, and the driving wheel in a vertical plane, the engine will travel in a straight line; but when the longitudinal shaft is turned round, and the driving wheel made to run upon one of its bevelled sides, the engine will describe a curve proportionate to the extent to which the longitudinal shaft is turned round.

Or the driving-wheel may be made with a straight periphery, and supported, with the engines, in a circular horizontal frame, which may be caused to move round in the main frame by means of a toothed wheel, keyed upon a vertical spindle, gearing into the teeth cut upon a portion of its circumference.

Or the steam cylinders and driving wheel may be fixtures, and the carriage turned round by means of a moveable axle, to

which a pair of running wheels are keyed, similar to the fore wheels of a coach.

Or the carriage may be propelled by means of impelling rods, which are attached to the free ends of the piston rods of the horizontal steam cylinders. These rods, which are supported in an angular position to the ground, are thrust against it at each outward stroke of the piston, and the carriage thereby driven forward. On the return stroke of the piston, the impelling rods are lifted off the ground by being drawn over an inclined plane. Or the impelling rods may be worked by eccentrics, the rings of which are connected by links to the upper parts of the rods.

3. Some improvements in propelling boats or vessels on shallow waters are next described. These consist in adapting the "impelling rods" before described and their motive machinery thereto. The free ends of the impelling rods may or may not be furnished with wheels, free to revolve in one direction only, or attached by a swivel joint.

4. The inventor proposes to construct such vessels, as are intended for the conveyance of passengers, with very deep and very narrow holds, employing in the propelling of them ordinary ships' sails, made fast at top and bottom to yards, and suspended in the air by balloons; the ends of the lower yards being attached by means of ropes to the bow of the vessel.

Claims.—1. The mode of generating steam by the general construction and arrangement of tubes and vessels containing water with the peculiar application of the fuel.

2. The various modes of propelling, drawing, and guiding carriages.

3. The modes of propelling boats or vessels on shallow waters by rods worked directly from the steam engine.

4. The mould of the vessel in contradistinction to that hitherto employed.

5. The application of ordinary ships' sails, suspended by balloons to the traction of vessels, and therefore to the transit or conveyance of goods and passengers.

NOTES AND NOTICES.

The Garland and New Star.—On Monday, 11th inst., H. M. Dover Mail Packet, *Garland*, was tried down the river, after a refit at Woolwich. The result of six runs at the measured mile in Long Reach, gave a mean speed of 13·363 knots, or 15·394 statute miles. The engines made 33½ to 34½ revolutions per minute. A quantity of coals and spare gear (belonging to the *Garland*, and the other Dover packets) brought her to her load water line, viz., 6 ft. 8 in. forward, 7 ft. aft. On her return, she fell in with the *New Star* Gravesend boat, and in a run from Erith to Woolwich, the two vessels proved to be of almost exactly the same speed; if there was any difference, it was on the side of the *Garland*. From the 27th May, 1846, to the 16th December, 1848, the *Garland* has steamed 25,139 nautical miles. She was built by the Messrs. Fletcher, from the drawings of Mr. Oliver Lang, of Chatham. Her engines are a pair of 60 horses power, on the oscillating principle, and were built by Messrs. John Penn and Son, Greenwich.

The Holyhead Mail Packets.—The following statement of the average performances of these packets is extracted from the last monthly report of Commander Charles Fraser, the superintendent of the Holyhead station. It will be seen that the *Banshee* (which was designed, like the *Garland*, by Mr. Lang, of Chatham) still holds the first place:—The *Caradoc* made 19 trips, averaging each 4h. 20m.; the shortest passage, 4h. 1m., W.S.W. breeze; longest passage, 5h. 20m., W.N.W., strong breeze. The *St. Columba*, 10 trips, averaging each 4h. 29m.; the shortest passage, 4h. 8m. W.N.W., fine breeze; longest passage, 5h. 5m., strong gale. The *Llewellyn*, 14 trips, averaging each 3h. 57m.; the shortest passage, 3h. 37m., S.S.W., breeze; longest passage, 4h. 15m., W., fresh gale. The *Banshee*, 13 trips, averaging each 3h. 54m.; the shortest passage, 3h. 35m., W.N.W., light breeze; longest passage, 4h. 27m. W., strong breeze.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Andrew Shanks, of Robert-street, Adelphi, Middlesex, engineer, for an improved mode of giving form to certain metals when in a fluid or molten state. March 14; six months.

John Smith, of Hare Craig, Dundee, factor to Lord Douglas, of Douglas, for improvements in the manufacture of flour, applicable to the making of bread, biscuits, and pastry. March 14; six months.

Robert Ross Rowan Moore, of the Temple, barrister-at-law, for improvements in the manufacture of letters and figures to be applied to shop fronts and other surfaces. March 14; six months.

George Fergusson Wilson, of Belmont, Vauxhall, gentleman, for improvements in the manufacture of candles and night-lights. March 14; six months.

James Williamson Brooke, of Camden Town, gentleman, for improvements in lamps. March 14; six months.

Thomas Clarke, of Hackney, Middlesex, engineer, and Thomas Motley, of Bristol, civil engineer, for certain improvements in obtaining and applying motive power, also improvements in railroads and other roads, and in supporting pressure, resisting strain, and protecting against fire. March 14; six months.

Robert Plummer, of Newcastle-upon-Tyne, manufacturer, for certain improvements in machinery, instruments, and processes employed in the preparation and manufacture of flax and other fibrous substances. March 14; six months.

William Payne, of 163, New Bond-street, Middlesex, watch and pedometer maker, for certain improvements in clocks and watches. March 14; six months.

Alexander Swan, of Kircaldy, Fife, manufacturer, for improvements in heating apparatuses, and in applying hot and warm air to manufacturing and other purposes, where the same are required. March 14; six months.

William Gratrix, of Salford, Lancaster, bleacher and dyer, for certain improvements in the method or process of drying and finishing woven and other fabrics, and in the machinery or apparatus for performing the same, part of which improvements is applicable to stretching woven fabrics. March 14; six months.

Ignacio de Barros, of Lisbon, Portugal, but now of Paris, gentleman, for improvements in machinery for making lasts for boots and shoes, boots

or stocks for fire-arms, and other irregular forms. March 14; six months.

Allen Bragg, of Queen's-row, Pentonville, bath-keeper, for improvements in propelling by atmospheric pressure. March 14; six months.

Francis Hay Thompson, doctor of medicine, of Hope-street, Glasgow, for an improvement or improvements in smelting copper or other ores. March 14; six months.

Pierre Augustin Chauffourier, of Regent's-quadrant, merchant, for certain improvements in the manufacture of watches. March 14; six months.

Peter Armand Lecomte Fontainemoreau, of South-street, Finsbury, London, for certain improvements in coating or covering metallic and non-metallic bodies. (Being a communication.) March 14; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subject of Design.
March 9	1804	Isabella Lambert	Manchester	Gaiter safeguard.
,,	1805	Enoch O. Tindall and Lorenzo Tindall	Scarborough	Vertical mangle.
,,	1806	Westley Richards	Birmingham	Percussion cap.
10	1807	William Simpson	Belgrave-road	Water valve, or hydrant, for supplying water from pipes.
,,	1808	John Edward Smith	Lawrence-lane, Cheapside	Combination shirt-waistcoat.
,,	1809	David Burges	Glasgow	Water pressure regulator.
,,	1810	Charles Cave Williams,	Glass-house Yard, Goswell-street	Buffing and drawing apparatus for railways.
13	1811	William Powell	Bristol	Fastening stoppers, for jars, bottles, &c.
14	1812	Isaac Parks	Birmingham	Penholder.
15	1813	William Powell	Temple-gate, Bristol	Stopper for jars, bottles, &c.
,,	1814	Richard Easthope	Birmingham	Cork extractor.

Advertisements.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleetstreet, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co. Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1337.] SATURDAY, MARCH 24, 1849. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

MESSRS. WANT AND VERNUM'S OSCILLATING CYLINDER LOCOMOTIVE.

Fig. 1.

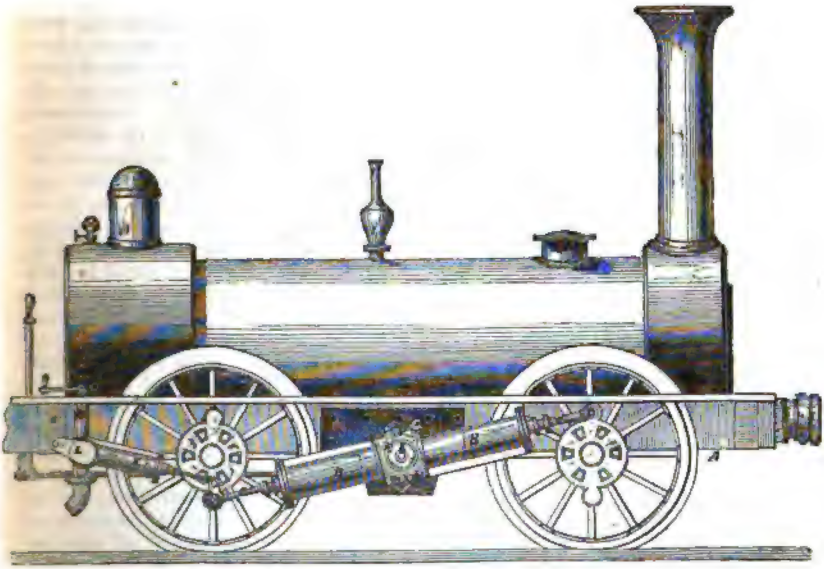
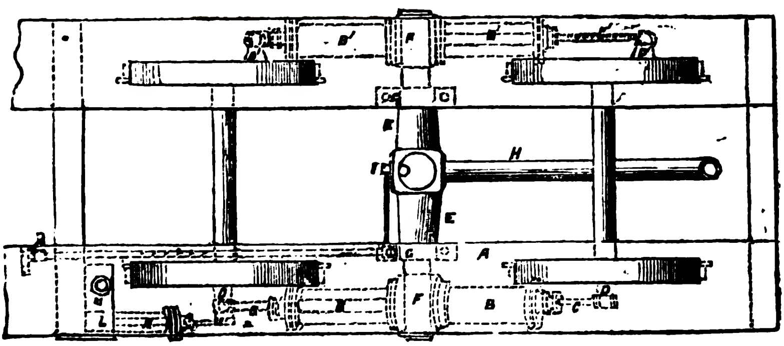


Fig. 2.



MESSRS. WANT AND VERNUM'S OSCILLATING CYLINDER LOCOMOTIVE.

The prefixed engravings represent a locomotive engine constructed by Messrs. Want and Vernum, on the principle of their patent of June 10 last. We have already given a general description of this engine (last vol., p. 580), but to enable the reader to understand fully the following details, without the trouble of reference, we repeat the principal parts of that description.

In this case they employ two pairs of cylinders; each pair consists of two cylinders connected end to end together, and the two pairs are centred on the opposite ends of the transverse hollow trunnion, on which they oscillate. There are also two air-pumps, one to each pair of engines. An arrangement of this sort is considered to be more especially applicable to heavy locomotives, as the weight of the one set of cylinders would act as a counterpoise to the opposite set, and thus throw the whole weight of the cylinders upon the trunnion, leaving the crank-pins and piston-rods entirely free from the load.

AA, is the framework of the carriage. BB and B′B′, are the two pairs of steam cylinders. CC and C′C′, are the piston-rods (each cylinder being provided with a separate piston-rod) which are directly connected to the four driving wheels of the carriage by the crank-pins, DD, D′D′. The connections between the piston-rods and the crank-pins are formed by ball and socket joints, so that the oscillations of the carriage may be thereby prevented from injuriously affecting the piston-rods or cylinders. E, is the trunnion upon which the pairs of cylinders are centred, and through which the steam is admitted and discharged, being in this respect exactly the same as the trunnion of the non-condensing engines before described (last vol., p. 578), save that it has double the number of ports entering into the steam passages, *a* and *b*, as represented in fig. 2, which is a cross section of the trunnion now in course of description, and the ports of the cylinders immediately in connection with it, (the occasion for this double number of ports arises from the application of the additional cylinders).

For the efficient working of engines in this locomotive application of them, the patentees say that it will "obviously be necessary in connecting the two cylinders together, of which each pair consists, that their centre or axial lines should be in the same straight line, and that the bearing, FF, for the trunnion should be bored out at right angles to the same line. In fig. 2, the bearing, FF, is represented as being formed out of projections on the bottoms of the cylinders, and cast in one piece with them; but the cylinders and the bearings may, if preferred, be cast separately, and afterwards connected by bolts and nuts. Should the wearing of either the trunnion or the bearings upon the cylinder bottoms render these parts leaky, this may be readily remedied by screwing up the bolts connecting the flanges of the two sides of the bearings, FF. When these bearings are bored out in the first instance, the patentee leaves a space between them at *ff*, by the insertion of a plate of metal or some hard substance, so that we may have it subsequently in our power to rectify any defect by the wearing of those parts, by inserting a thinner plate of metal in the place of that originally used."

When the bearings of the axles of the wheels of the locomotive are rigidly affixed to the frame of the carriage, then the cylinder trunnion must be also securely affixed to the framework; but as the bearings of the wheel axles are generally allowed some latitude of play up and down in the framework to which they are attached, through the medium of springs, it will also in such case be necessary to give the trunnion and cylinders a corresponding play vertically, because if any of the wheels should be raised up from any unevenness of the rails, or occasional obstruction, the raising of the wheel would be apt to bend or break the piston-rod. Messrs. Want and Vernum therefore allow the trunnion, F, to have such a degree of vertical play as may suffice to prevent such accident, and this they accomplish by placing the trunnion in slotted bearings, G, which are attached to the framework (as shown in fig. 1.) These slotted bearings are provided with helical springs above and below the trunnion, to prevent its working up and down, except where it may be necessary for it to do so. The steam pipe connecting the boiler with the trunnion, F, is provided with a packed telescope-joint, which admits of the pipe

lengthening or shortening, according as the trunnion is removed further from or nearer to the boiler by the vertical play which is allowed to it in the bearings, GG. H is the exhaust pipe; I, a six-way cock, for reversing the motion of the engines, or for shutting off the steam altogether from the cylinders. K is a feed pump for supplying water to the boiler, and which is similar, both in form and in action, to the air pump and steam cylinders, described, vol. lxix,, p. 580. L is the trunnion, upon which K oscillates; and M, a three-way cock, by which the driver directs the course of the water through the trunnion, according as the engine may be going forward or backward. This three-way cock is exactly of the same construction as the six-way steam cock; and it has but three ways because there is only one feed pump supposed to be employed; but when two force pumps are used, then the three-way cock must be changed for a six-way one.

A light class of locomotive engines may be constructed with one pair of single cylinders, one cylinder on each side. Or, again, instead of having a second cylinder upon the opposite side of the trunnion, a single cylinder at one end only may be used, with a weight at the other end to counterbalance it.

In locomotive engines of this sort, the hollow trunnion of the cylinders should always be permanently and securely fixed to the framework, as it is not necessary that it should yield along with the side bearing of the wheel to which the piston-rod is attached.

MATHEMATICAL PEROIDICALS.

(Continued from page 9.)

XIV. *Mathematical Exercises.*

Origin. — The periodical appears to have begun immediately after the discontinuance of the *Mathematician*, the first number being published towards the close of the year 1750. In the preface it is stated that it might "perhaps be thought unnecessary to trouble the world with this performance, at a time when so many of the like kind are already extant. Butif we consd er the imperfections which most of them lie under, either through want of ability or care in the authors, we hope what is here offered to the public will not prove unacceptable. The charge of "want of ability" no doubt was intended principally to apply to Mr. Heath, the *then* editor of the *Ladies' Diary*, whose failures on this account, both in the *Diary* and the *Palladium* were somewhat notorious. The *Mathematician* silently and effectively advocated the cause of truth and science, and the elegance and usefulness of the questions and their solutions in this work contrasted strangely with those in the works of which Heath was the avowed editor. His irritability, in consequence, became proportionately increased, and not content with "venting his spleen" against Mr. Simpson in the *Diary* and *Palladium* he infused his "leaven of gall," as Turner has it, into the reviews and broad sheets of the day, and seemed anxious to make up with falsehood and bitterness what he wanted in ability. The *Mathematical Exercises* were therefore "set on foot" to use the words of Dr. Hutton, "to afford a proper place for exposing the errors and absurdities of Mr. Robert Heath and the *Palladium*," and also to exhibit the value and vindicate the character of Simpson's writings. The "controversy between them" ended in the expulsion of Heath from the editorship of the *Diary*, and the *Exercises* having "done their office," were discontinued with the sixth number immediately on Mr. Simpson's being appointed editor of the *Diary* in the early part of 1753. The whole work forms an octavo volume of iv. + 294 pages.

Editor.—Mr. John Turner, of London.

Contents.—The first number contains a treatise on "The Projection of the Sphere," divided into two sections, of which the first treats "Of the Orthographick," and the second "Of the Stereographick Projections." The use of the first kind of projection is shown "in the Geometrical Construction of Spherical Triangles," and in deriving "several useful Theorems," for the solution of spherical triangles: — the use of the second kind is exhibited in its "application to the Projection of the Circles of the Celestial Sphere." This portion of the volume concludes with "a collection of new problems for solution," most of which have only a single initial as the proposer's signature. The second number contains "The Investigation of

the Sums of Series, by *Xa-kia*:"—in which by means of the geometrical progression

$$1+x+x^2+x^3+\&c.=\frac{1}{1-x},$$

when x is less than unity, and the use of the fluxional calculus, many curious and interesting series are elegantly summed. A treatise on "The Principles of Dialling" is commenced in this number, and continued under a separate paging through the succeeding ones, so that the whole treatise consists of 40 pages. It contains geometrical descriptions of horizontal; erect south and north; erect east and west; direct south and north; direct east and west; and also the usual declining dials:—a few pages at the end of the treatise are devoted to "The Construction of Dials from the Doctrine of the Sphere." Two paradoxes were proposed by Mr. Graham, and two enigmas by J. S—s; these were answered in the third number by the proposers and Mr. Widd, but no others were afterwards inserted. The fourth number contains, "A Method to Determine a Vulgar Fraction nearly equal in Value to any Decimal one proposed;"—"Some observations concerning Fluents, by Waltoniensis" (Mr. Landen);—and a collection of "Memorial Verses adapted to the Gregorian Account, or New Style," mostly by J. Canton, Esq., M.A., F.R.S.: a few of the latter being somewhat curious are here transcribed, *verbatim et literatim*.

To Know if it be Leap Year.

Leap year is given, when four will divide,
The cent'ries compleat, or odd years beside.

To Find the Dominical Letter.

Divide the cent'ries by 4; and twice what does remain
Take from 6; and then add to the number you gain
The odd years and their 4th; which dividing by 7,
What is left take from 7, and the letter is given.

By the Dominical Letter to find on what Day of the Week any day of the Month will fall throughout the Year.

At Dover dwells George Brown, Esquire,
Good Christopher Finch and David Frier.

To find the Golden Number, Cycle of the Sun, and Roman Indiction.

When 1, 9, 3 to the year have added been,
Divide by nineteen, twenty-eight, fifteen.

To find Easter Day.

From limit take the letter, adding four;
From the next sevens what's left still take away—
What still remains, with limit found before,
Gives Easter Sunday from St. David's Day.

To find the Time of the Moon's coming to the South, and of High Water at London Bridge.

Four times the moon's age, if by 5 you divide,
Gives the hour of her southing; add 2 for the tide.

From the preceding specimens, it would appear that Mr. Canton scarcely "lisped in numbers," as his productions are much more *practical* than *poetical;* however, his "memorial verses" were considered valuable in "their day"—so much so that Heath made no scruple to reprint them, "metamorphosed and disguised," in the next number of his *Lady's Philosopher*. The fifth number contains some editorial remarks on certain fluxional equations, and also "Some New Forms of Fluents, by Haverfordiensis." He speaks indignantly against the practice of quoting an author for what he has only copied from others, and says there is "scarce a single fluent in any of our present mathematical authors but what may be met with in *Sir Isaac Newton's Quadratures*, and *Cotes's Harmonia Mensurarum*." The Editor, however, demurs to this, and "presumes that his correspondent has not seen Mr. Simpson's last book of Fluxions." In the second number of this work are found some "*Observations,*

by John Turner, *on Certain Invidious Aspersions on Mr. Simpson's Doctrine and Application of Fluxions*, published in the *Monthly Review* for December last, by Cantabrigiensis;" which form the *first* of a series of papers in defence of Simpson's writings, and introduce the reader to the celebrated controversy between "the Half-pay Captain" and "Madam John."

From the *nature* of the article in the *Review*, and the *manner* in which it is "mentioned by the author of the *Gentleman's Palladium*," the writer is supposed to be Mr. Heath, who takes upon himself to charge Mr. Simpson with "*confusion, mistakes*, and *plagiarism*," and also to assert that he had exhibited "neither *method, conciseness, perspicuity, accuracy*, nor *judgment*." To these charges Mr. Turner replies *seriatim*, and shows that the "*confusion* exists" only in the reviewer's "own imagination, and nowhere else;"—that "his assertion that Mr. Simpson had *mistaken* the *effect* for the *cause*, is equally unjust and without foundation, and what follows thereon, downright nonsense;"—that the "imputation of *plagiarism*," is the "most injurious reflection that malice and ill-nature could suggest," seeing that "*not one half* of the things given by Mr. Simpson" relating to the "fluxions of the sides and angles of spherical triangles," is to be found in "*Cotes's Estimatio Errorum*," and "his method is also quite different." With respect to the "particulars produced to prove that the author (Simpson) has neither *method, conciseness, perspicuity, accuracy*, nor *judgment*," Mr. Turner makes "it appear, to a demonstration, that the *commentator* has neither *veracity, perception, reason, sense*, nor *modesty*;" and an insinuation that "Mr. Simpson assumed the title of the Doctrine and Application of Fluxions to his late work," to "*give it a character and make it sell*, as being Mr. Emerson's title to a treatise of his on the subject," is treated with the indignant contempt it deserves. The observations conclude with an allusion to the assistance Emerson was supposed to afford to the "compiler of the *Diary* and *Palladium*," which confirms what has been advanced on this subject in the notice of the *Mathematician*. The Editor next obliges "the curious with certain advertisements, sent by an unknown person, the four first of which appear to have been printed in the *Daily Gazetteer* for December last" (1750.) No. I. is addressed "To the Worshipful Company of Stationers," by *Honestas*, and states, "that all the best materials designed for the *Diary* by the contributors are selected out and reserved by him (Heath) for his said *Palladium*," and that "any person, by *comparing together* the two performances for the ensuing year (1751), will soon be convinced that though the best of them is far from being perfect, yet the *Diary* is by many degrees the worser," and this "the very worst that has yet appeared." No. II. is by "the author and compiler," in answer to the above, and is addressed to the same "Worshipful Company." He "does not take upon him to determine whether the author of that advertisement (No. I.) is a *knave* or a *fool, spectre, dæmon*, or *apparition*, and therefore thinks himself not culpable for what is said of him in the dark, without proof;" but he challenges *Honestas* to appear *personally* at Stationers' Hall, and "discuss the matter of fact before impartial judges;" he also offers a reward to "any *honest man* that will discover who this ingenious writer is," though, from a succeeding paragraph, it would appear he had a good inkling of his personal identity. "The author and compiler of the *Palladium* and *Ladies' Diary*," however, carefully avoids replying to the charge of "reserving the materials," and does not seem *very* willing to make the *odious* comparison recommended.

No. III. is from *Honestas*, and is addressed to the "compiler of the *Ladies' Diary*." He reminds him "that when a disputant leaves the point in question, and falls to swaggering and raving, it is a certain sign that he either has a bad cause to manage, or wants sense and temper to make the best of a good one;" that he has "either entirely forgot, or *wisely* omitted, to take notice of the principal matter urged against him;" and that if he could "have fairly made it appear that he had never converted to his own use what was intended for the *Diary*, he needed not to have been under such furious agitations about a *knave, fool, spectre*, or a *dæmon*." He regrets that the "once useful work (*Diary*) is now no better than an incorrect, poor

performance, abounding with the most enormous absurdities," and instances two of the questions in the *Diary* for 1751, as proofs "*that the Diary has greatly sunk in its value, either through the inability or designs of the conductor.*" No. IV. is in reply to *Honestas*, and is again addressed "To the Worshipful Company of Stationers." Heath accuses his opponent of cowardice for not appearing "in *propria persona*"—calls him a "sham litigant," who "deserves only contempt or pity for his gross ignorance and abandoned conduct, acting like an *assassin* in the dark!" He states that "the *Ladies' Diary* depends more on amusement for the *fair sex* than on the propriety of mathematical problems," which concern "but about 500 buyers," whereas, by the addition of a *Ladies' Oracle* and other improvements, the sale of it had been increased by several thousands," whilst the sale had "before *sunk* by being overloaded with the *problems* and *solutions*." He also informs the "Worshipful Company" that "*our Palladium* was forced to supply every reader with their humour," and as "every thing therein is connected with what the *Diary* contains, they ought to be read together." *Rather* an adroit way of admitting the *depreciation* of the *Diary* and of recommending "*our Palladium*" in the same breath! In a postcript, the "Company" is informed that *Honestas* "took his degree in a tobacco *hogshead*, and has taken the oaths to a prostitute writer in town, as we are informed; and the best writer against both is ONE who shall sign the warrant for their execution." These allusions, says a high authority* on these subjects ["seem intended to apply to Simpson and Turner"], but in what manner can scarcely be conjectured; a reference is made to the *Palladium* for some further remarks equally obscure, where ["Heath had printed the most ridiculous ribaldry that ever was intended for wit."] If the important monosyllable "*one*" was intended to imply the results of his own prowess, never was a "poor knight of La Mancha" more egregiously mistaken. No. V. is a reply from *Honestas*. He points out the somewhat ridiculous subterfuges of the "Compiler" suiting so "ill with the character of a philosopher and mathematician, from whom the world is promised such wonders;" and considers "of all men living, he (Heath) has the least reason to complain" of engaging "in a dispute with an unknown person." He indignantly asks him, "How many persons of reputation and superior genius have you, under different *fictitious names*, grossly insulted and abused? Even to that degree, that the *Diary*, under your hands, has become remarkable for scandal and defamation, which are there dealt out with unbounded license;" and he concludes by declaring that "to see men of distinguished merit, and the most amiable characters, treated with such insufferable insolence by a wretched pretender, must fill every generous mind with indignation, and make them despise the wretch whose faults they might otherwise be inclinable to pardon." The preceding remarks are strongly expressed, but not more so than the occasion required. [In the *Diary* for 1751, some queries are inserted under the signature "Philanthropus," evidently intended to injure the characters of Simpson and his friends, by insinuating that they were nothing more than ignorant "impostors and enemies of the public." The tirade concludes with the following lines, "which admit of no difficulty of application to Simpson and his advocates,"] since Heath distinctly charged them with being "Collectors from FRENCH and LATIN mathematical authors and puffers of performances:"

> "And why should *commentators* view,
> In *Newton* more than *Newton* knew?
> Why should *translators* be professors?
> And ignorant parsons made successors?"
>
> *Ladies' Diary*, 1751, p. 42-3.

The preceding reply appears to have given Heath his *quietus* so far as the public journals were concerned, and though he afterwards published various pamphlets on the subject of the controversy, he allows *Honestas* the undisturbed possession of his "vantage ground." Most probably the "compiler" *knew* too well the superiority of this "*unknown person*" to molest him further; and it is to be regretted that no positive proofs of the identity of his able antagonist are now to be found. It

* For the sake of distinction, the valuable and interesting remarks of this gentleman will be enclosed in brackets; his readiness to afford information deserves every acknowledgment, and my obligations to him are both numerous and extensive.—T. W.

has been conjectured, and most probably is correct that ["*Rollinson* may have been *Honestas*. He does not appear *personally* in the dispute; yet as the *Mathematician* was begun for the same purpose (as the *Exercises*) and is conducted in a more moderate tone, it is far from unlikely that he performed his part in the *Gazetteer*. *Honestas* appears in the *Ladies' Diary*, 1751, as the proposer of a new tariff! He would tax *ladies' hoops* and take off the duty from *soap* and *candles!* His reasons are good: "whereby a present extensive inconveniency would become a public service, and the industrious part of mankind be relieved."] A glance at the fashions of the day in the "Pictorial History of England," vol. iv., p. 806, will show that good reasons existed for such a proposal. The third number of the work contains "Some remarks on a late Scurrilous Pamphlet in answer to the Observations published in our last Number in Defence of Mr. Simpson's Fluxions, by John Turner;" in which the "*imaginary* Cantabrigiensis" is handled in a manner equal to his deserts. His objections to Simpson's Fluxions and Turner's Defence, as might be expected, turn out to be unfounded; they are shown to be "the *poor* artifices of a little, shuffling, adversary," who is "*grossly ignorant of the most common parts of the subject.*" From a postscript we learn that he had also fallen foul of De Moivre, whom he accused of inaccuracy, and did not scruple to propose "the printing of Mr. Abraham De Moivre's *Doctrine of Annuities*, corrected and improved by himself (Heath), notwithstanding that" De Moivre had just published "a new edition of that very work." The article concludes with "A Letter to the Author, by *Honestas*," in which the imperfections of the *Diary* for 1748, are very amusingly pointed out. The editor of the *Diary* is stated to rise "greatly conspicuous by his own ignorant blunders; for having first (as usual) *corrected the data* he solves (the 12th question) his own way, and then very modestly tells the world, it was

Answered by Mr. Heath *only!*"

This censure was by no means undeserved, as will appear on reference to the *Diaries* of the time, and in this very year ["Heath gives the prize to himself!"] so desirous was he of "appearing considerable, in spite of nature." In the fifth number the subject is resumed, and we are presented with "A short Examination of a Pretended Answer of the *late* Compiler of the *Ladies' Diary* to the Charge of Falsehood and Ignorance exhibited against him, in our third Number; with some Observations on his last Scurrilous Pamphlet," by John Turner. Three points of the controversy are here discussed *seriatim*, viz.:

1. "The Author's (Simpson's) Definition of a Fluxion.

2. "His method of Solving a Fluxionary Equation.

3. "The Assertion of this Opponent (Heath), that *the Author publishes Nothing but by the Assistance of Others.*"

Under the first head Simpson's deviations from the methods laid down by Sir Isaac Newton are maintained and shown to be justifiable. The second head is somewhat summarily disposed of by Waltoniensis (Landen) in the postscript, of a letter sent to the editor in March, 1752. He says "What a dunce was *Heath* to object to Mr. Simpson's correction of this fluent! I took no notice of it till lately. A goose of a critic, indeed! He rightly calls himself *Critic Anser.*" Mr. Landen evidently alludes to ["a series of running comments on the solutions in the *Diary* for 1749, professedly by Heath, and bearing the title of "*Critic Anser's Annotations*;"] he perhaps little dreamt of Landen's application of the signature! Upon the subject of the third head "the *late* compiler appears to have been more than usually eloquent. He styles 'John' a 'Polite Lady,' and flourishingly asks why 'Madam' is so 'captious about trifles?" when we all know *who corrected the proof sheets* of his favourite Fluxions, when and where." "How then is your favourite author WRONGED by our saying he was assisted? Don't we all know he stands supported by AMANUENSES, REVISERS, and ADVOCATES (yourself one) to which may be added GRAMMATICAL PEDANTS, Haberdashers of POINTS and Syllables; Refiners of Diction; Correctors of Sentiment, CASTRATORS of redundant Members of PLAGIARISM; Collectors from FRENCH and LATIN mathematical Authors; and Puffers of Performances!" To such a mass of high-sounding twaddle a simple negation would obviously

be a sufficient answer, notwithstanding all the force of the capital letters; and accordingly "Madam" contents himself with little more. He states that "every thing here said, or insinuated, is *utterly false*, except with regard to the correction of the (first) proof sheets;" that the *second* proof sheet was always sent to the Author himself," and that "not a word, or a point, (was) altered from the Original Copy, but by the Author." From the title, and some remarks at the close of this article, it appears that [" although Heath *made up the Diary* for 1753, he was superseded by the Stationers' Company and the *completion* of the number put into Simpson's hands;"] so we have at least one reason for the very singular language previously quoted. He also seems, from his own allusions, to have commenced a new periodical in opposition to the *Diary* entitled the "*Ladies' Philosopher*," and made an attempt "to get all the Letters designed for the *Diary* into his own hands;" a proceeding which certainly adds no pleasing trait to his already unenviable character. On the whole, the "Half-pay Captain" appears to have been thoroughly beaten; manœuvre as he pleases he is invariably *out*-manœuvred, and though he occasionally musters "a folorn hope" "and storms furiously," no friendly breach is found through which to force an entrance. The steadiness and ability of his opponents successfully resist every effort, so that he is ultimately compelled to "sound a retreat," and retire behind his entrenchments defeated and disgraced.

Questions. The number of questions proposed and answered in this work is 81, and, as might be expected from the circumstances under which they were proposed, many of them are of a very superior character. The principles upon which the investigations are based are in general clearly and copiously laid down, and on this account are more valuable to junior students than when wrapt up in the usual curt style of the present day. Of the solutions, 14 belong to Algebra; and 17 to geometry, &c.; 19 to trigonometry; 13 to mechanics; 15 to fluxions and its application; 8 to the application of algebra to geometry, &c.; and the rest to conics; hydrostatics; chances; loci and annuities. The 22nd question is No. 339 in the *Ladies' Diary*, and is one of those to which *Honestas* objects in his second letter to the *Daily Gazateer*. The proper *data* for the calculation are here supplied, which was not the case in the *Diary*, Messrs. Ash and Gibbons having founded their solutions upon an experiment by Dr. Desaguliers in the *Phil. Trans.*, No. 375, p. 269. The 28th finds the values of x, y, z, &c., when their sum, sum of squares, sum of cubes, &c., are given. Two cases of this problem form questions 14 and 18 in the *British Oracle*, and a *general* method of solution is given in Art. 19 of *Dr. Hutton's Miscel. Math.*, by Mr. George Coughron. The principle upon which the question is solved in the *Exercise* appears to be identical with that in the article cited. *Ques.* 35, 47, 50 relate to the "Curve of Pursuit." The first is the same as question 310 in the *Ladies' Diary* for 1748, but no solution was printed, although Mr. Landen is said to have given a true one. The subject appears to have been a favourite speculation "in those days," and an excellent paper on the "curve" by the late Mr. Samuel Jones, of Liverpool, may be seen in the Appendix to the *Gentleman's Diary*, for 1839, in which various references to other solutions are given. Ques. 38 is proposed by *Honestas* and is the *second Diary* question alluded to by him in his letter to the *Gazetteer*. The question was improperly proposed in the *Diary*, and if reference be made to *Ques.* 344, it appears to be "*answered by* Upnorensis *only*," and affords an amusing specimen of Heath's method of getting over a difficulty. *Ques.* 39 is proposed by Mr. Thomas Moss, and proves that "the perpendiculars of any triangle meet in the same point." It forms Cor. 5 to Prop. IV. of the article "Transversals" in *Davies's Hutton*, and may be met with in almost any treatise on Analytical Geometry. This is, however, probably the *earliest* instance of its occurring in an English work. *Ques.* 43 is proposed by Waltoniensis (Mr. Landen), and gives the relation between the sides of a triangle, the segments of the sides, and the segments of the lines drawn from the angles through a point within it. The question answers to Prop. V., "Transversals," in *Davies's Hutton*, and was solved by the proposer from [" Statical considerations, a method much practised in later times by the French geometers."] A purely geometrical solution is given by

"ΣΕΜΝΟΣ," probably Simpson, which differs little from the present mode of conducting Transversal inquiries. Mr. Landen appears to have been the *first* to propose this curious question.

Ques. 56 is a neat property of the trapezium proposed by Landen, under his usual signature, at that period, of "Waltoniensis." It seems but little known, and is here transcribed.

"In the trapezium A B C D if any right line mn be drawn through p, the point where the diagonals intersect each other; then $Am \cdot Bn : Cm \cdot Dn :: Ap \cdot Bp : Cp \cdot Dp$."

Ques. 59 was proposed by Mr. W. Toft, and shows where to cut a tree, so that when measured by the *common* rule the part next the greater end may be a *maximum*. Some curious particulars relating to this subject may be seen in *Dr. Hutton's Mensuration*, and several other works. *Ques.* 73 demonstrates that "a line from either of the acute angles of a right-angled triangle to the centre of the inscribed circle is a mean proportional between the hypothenuse and the excess of the hypothenuse above the opposite leg;" two other demonstrations of the same property, by Mr. John Baines, may be seen in the *Leed's Correspondent*, vol. iv., p. 314—5. Many of the questions are proposed and answered under the disguise of Greek signatures and assumed names; but from the nature of the subjects to which they belong it is not improbable that most of them are *due to Simpson*, since Turner appears under his own initials in pp. 32 and 144.

Contributors. Barker, Brownbridge, Curiosus, E. B. M., George, Ghiss, Graham, Kay, Landen, Leigh, Lupus, Marshall, Moss, Nauticus, Northouck, Phipps, Proteus, Rollinson (R—on), R. R. H., Tommy Tangent, Toft, Trott, Turner (T—r), Watson, Weston, Widd, &c., &c.

Publication. The publication appears to have been half-yearly. The first number was issued towards the close of 1750, and the last (printed at Wrexham) in the early part of 1753. Five of the first numbers were "printed for James Morgan, at the *Three Cranes*, in Thames Street, London," and the last "by R. Marsh, Wrexham." All the numbers were subsequently sold, at "one shilling each," by "J. F. and C. Rivington, St. Paul's Church-yard, London."

THOMAS WILKINSON.

Burnley, Lancashire, March 2, 1849.

HINTS ON THE OCCASIONAL EMPLOYMENT OF THE MANUAL POWER OF SHIPS' CREWS AS A SUBSTITUTE FOR AUXILIARY STEAM POWER IN PROPELLING VESSELS OF WAR.

It appears, from the Report of the Select Committee on Naval Estimates, that the preparation of steam guard-ships has been attended with so heavy an expense, that proceedings on the measure have been discontinued. The *Blenheim* had for this purpose "required an outlay of above 43,000*l*. on her hull, and above 25,000*l*. for machinery, before she was completed as a steam guard-ship"—yet, Lord John Hay stated in evidence, that vessels so fitted "would *not* prove efficient as war steamers for sea-going purposes."

It further appears that the cost of the steam apparatus, the high pay of engineers, and the coals consumed in all steamers of war, are expended for a very small amount of actual service of the steaming apparatus—vessels of war differing from private traders, in that the latter are remunerative only from the great number of voyages they make, compared to sailing vessels in a given time; whilst the vessel of war usually has only to cruise on a certain station, without use for great speed, excepting on some occasions of emergency. The two descriptions of vessels, the trader and the man-of-war, differ also in another respect;—the trader carries no more hands than those requisite for navigation—the vessel of war has a crew, perhaps, ten times as numerous as that of a merchantman of equal tonnage, that extra number being provided to man the guns. The vessel of war, then, when not actually engaged with an enemy, has a great amount of human force at its disposal; in a vessel of about 500 tons, for example, not less than two or three hundred men unoccupied, but who might be employed in giving motion to the vessel.

The application of this human force to such a purpose has, in small vessels, been frequent by means of oars or sweeps. The *Millbrook*, at a first trial with raw hands, made two and a half knots an hour in a dead calm; and afterwards, when her

crew were more experienced, she could row much faster. It was by means of sweeps that the *Bellone* got away from the *Millbrook* after striking. But as it can only be a small number of men that can be put to oars or sweeps in the usual way, other means of applying the force of man for the same purpose have been frequently proposed, and various contrivances have been devised for carrying the plan into execution; but they have all of them, unfortunately, been in some respects defective or objectionable; and as an important use of the *Mechanics' Magazine* is to draw attention to objects of utility not yet attained, and as the introduction of means less costly than steam for giving locomotion seems highly desirable, particularly as to guard-ships and coast defence, the ideas of Sir Samuel Bentham on the subject may, though he had not perfected his plan, be of some use in the contrivance of an efficient apparatus for the purpose in question.

Sir Samuel having had considerable experience in Russia of the modes he had devised for giving locomotion in river navigation, as also in actual warfare at sea in the *Liman of Otchakoff*, turned his attention, in the year 1830, to the means of giving locomotion to sea-going vessels of war by means of their crews, and began, as was his custom, whatever were the objects he had in view, by noting, for his own use, all such particulars as it seemed essential to keep in view when contriving the means of producing any desired effect. Those notes were as follows:

The application of the force of man to the giving locomotion to vessels of war.

The properties that present themselves as desirable in the application of this force are as follows:

1st. That the apparatus should cause the whole force to act against the water in which the vessel is afloat, and to be so applied as to be in the direction, the best suited to give progressive motion, instead of paddle-wheels or other circular apparatus.

2ndly. That where paddle-wheels, or other apparatus for giving locomotion by means of steam, are already fitted to a vessel, the apparatus for the application of the force of man should be adapted to the apparatus, paddle-wheel or other, already fixed, so that this force should be occasionally employed in lieu of steam.

3rdly. That it should be such as to admit occasionally of applying the force of the whole of the crew.

4thly. That it should render apparent how much force each man actually employs.

5thly. That it should be such as that the man, whilst applying his force to give motion, should be little liable to be disarranged or obstructed by the motion of the vessel.

6thly. That it should occupy little room; particularly that it should interfere as little as possible with the other operations required to be carried on at the same time—especially that most needful one in a vessel of war, the use of the guns.

7thly. That the apparatus should be altogether simple, light, little liable to be put out of order, easy of repair, little cumbersome when not in use.

8thly. That it should be suited to the application of the same force to other operations necessary on board ship, such as pumping, raising and lowering sailing apparatus, &c.

Satisfied that sailors are less annoyed by applying their force as in rowing, than in any other manner, Sir Samuel contrived an apparatus by which they were to be employed in a similar way for giving motion to a vessel. It was an endless rope or chain, connected with the machinery intended to be moved, whether paddle-wheels or screws, if already fitted, or any other more efficient apparatus; this rope or chain supported here and there round a considerable part of the deck, in a manner so as to be easily placed when needed, and as easily taken away when not in use; this endless rope or chain worked by the men sitting, as in rowing, and giving the stroke with both hands. A model was made of the part to be held by each man; it was a light, double-handled frame, which seized the rope or chain, and held it fast whilst the stroke, as in rowing, should be made; when, on the turn of the handles, the hold of the rope was loosened, leaving the handled frame at liberty to be advanced the length of a stroke; by the next turn of the hands, the frame again held tight the rope, ready to be advanced another length of stroke: thus, as in rowing, the amount of force obtained would be that of the joint strength of the number of men employed.

That model was submitted to the Lords of the Admiralty in September, 1842 (but has not been returned); it was accompanied by a short letter, saying that "Sir Samuel Bentham had considered that the efficiency of vessels, men-of-war especially, might be greatly increased were means provided to enable the crew, in cases of emergency, to give motion to the vessel independently of wind or steam"—instancing such emergencies as "working off a lee shore, entering an enemy's harbour for attack, or the placing a ship speedily at her intended station before an enemy's fort, the overtaking a flying vessel at sea, or the changing the position of a ship in action." At that time the advantages of steam navigation were alone looked to, and no thought was taken of expense, so that the Admiralty acknowledging, through their secretary, the receipt of the model, indicated that their Lordships "did not think the proposal applicable in the present day." Since that time, experience of the immense cost of steamers for war purposes, would doubtless cause a very different view to be now taken of any well-devised apparatus which might, independently of steam, enable a vessel to be moved with certainty against wind or tide, even were the use of the invention to be confined to guard-ships and others for coast defence. M. S. B.

STENSON'S PATENT STEAM BOILERS.

Sir,—In my last communication respecting steam-engine boilers, I gave what I deemed a sufficient answer to Mr. Medworth's remarks; and am quite willing to allow all the merit due to him for inventing, in less than "twenty-five hours," a boiler which was patented by another person, and illustrated in your Magazine some four or five years previously!

My examination of Mr. Stanley's small steaming apparatus at York was in compliance with a request, and went no further than *feeling* that the crown plate of the boiler over the furnace had vertical tubes inserted in it;—hence my observations upon it, as before referred to.

The boiler to which the accompanying (and unsolicited) letter refers, and *which did not occupy my mind twenty-five minutes* in inventing, is constructed in accordance with one of the "twelve different arrangements" described in my specification, and, being of a practical character, may possibly convince Mr. Medworth of its value.

A steam engine is now being erected in connection with this boiler, and, after a series of careful tests, I hope to furnish you with a further report as to its economy; in the mean time, being fully occupied in making steam engines with the patent boilers —under an increasing pressure of orders—I shall, for the present, allow Mr. Medworth to boil his potatos in peace.

I am, Sir, yours, &c.,
J. Stenson.

Engine and Mill Works, Northampton.

(COPY.)

Burton Mills, near Higham Ferrers, Northamptonshire, March 12, 1849.

Messrs. Ogg, Howard, Butlin, and Stenson.
Gentlemen,

Having got steam up in your new 25 horse boiler, and worked our dyehouse three days and weighed coal, we are very much gratified in being able to say that our saving over our old boiler is 15s., say fifteen shillings daily, and steam blowing off all day, more than we can use. Having calculated the power, I can boil six thousand gallons of water in 45 minutes, at a cost of 9¾d.

Your obedient servants,
George Davis & Co.

7½ cwt. of coal is our quantity burnt.

STRENGTH OF GLASS PIPES—DECISIVE EXPERIMENTS.

Dear Sir,—In consequence of the perusal of the editorial remarks as to the probable "why or wherefore" glass pipes were not substituted for pipes of lead at Claremont, I gave directions to the chief mechanic at our works to prepare hydraulic apparatus for testing the strength of glass pipes—such as are ordinarily made at the Nailsea Glass Works.

All the pipes submitted to trial were cut to 3 feet in length. Their internal diameters varied from 1½ inches to 2¾ inches. The various thicknesses ranged from one-eleventh to three-sixteenths of an inch. In every instance each pipe sustained an internal pressure of 672 lbs. per square inch. In two instances only did any pipe burst with a less pressure than 784 lbs. per square inch. In all the other trials every tube was removed, unbroken, under a pressure of 1568 lbs. per square inch. To you I offer the first rough statement that has yet appeared on this interesting subject. I need not inform you that a series of experiments are in progress which, when complete, may possibly prove somewhat astounding "to engineers and others," whose duty we have hitherto considered it to be, to experiment for themselves, upon captivating novelties touching their own art.

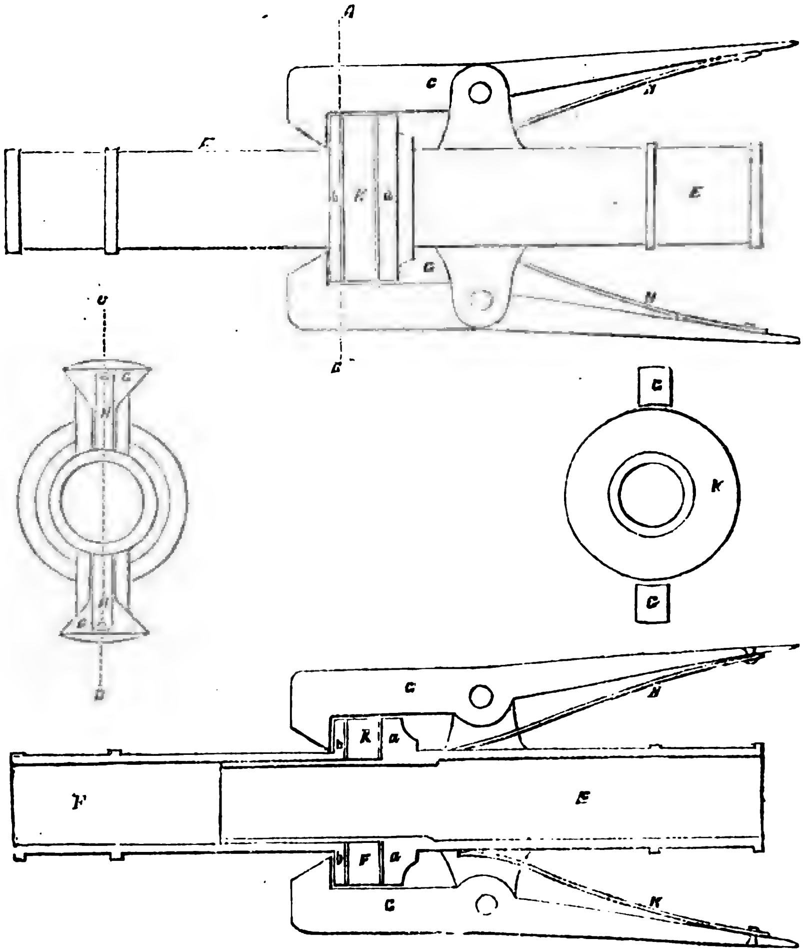
The more minute, as well as the more extended matters of interest, must be reserved for a future communication.

I am, Dear Sir, yours, &c.,
Chas. Thornton Coathupe.

Wraxhall, near Bristol, March 20, 1849.

THE BROMSGROVE IMPROVED PIPE-JOINT AND FASTENING.

[Registered under the Act for the Protection of Articles of Utility. The Bromsgrove Railway Carriage Company, Proprietors.]



The above figures represent the parts of this joint and fastening, both in section and in elevation. E is the end of a tube or pipe, to which there are attached the two spring catches, GG, one on each side. K is a washer of vulcanized India-rubber, which is slipped on the end of the pipe until it abuts against the collar, *a*. F is the end of the adjoining pipe, which is made sufficiently large to take on to the pipe, E, when it is pushed forward against the vulcanized washer, K, till the catches, GG, lay hold of the flange, *bb*. The springs, HH, keep the catches, GG, in their holding position.

The chief advantage of this joint is, the remarkable facility with which it may be made and undone; and on this account it seems particularly applicable to the purpose of connecting the lengths of gutta percha, or other telegraphic tubes.

THE ARTESIAN WELL AT SHEERNESS DOCKYARD.

All the water required for use in Sheerness Dockyard, and also for the supply of fleets coming into that port, had formerly to be brought in boats from Chatham; but in April 1800, Sir Samuel Bentham proposed to obtain water at Sheerness itself, by means of a deep or artesian well. This important and economical improvement was subsequently carried into effect according to his plans. A most abundant quantity of particularly excellent water was obtained; it was raised by a steam engine, and kept in readiness for the sudden demands of a fleet, in a reservoir containing 1000 tons. In contriving the details of this work, he introduced an *egg-shaped drain*,—the first invention (it is supposed) of that form. A section of this drain is prefixed, and some explanatory particulars extracted from Sir Samuel's papers, are subjoined. It will be seen that Sir Samuel employed his principle of interconvertibility in other works than those of ships; the Sheerness drain having been designed so as to serve either for its direct purpose of a drain, or for a reservoir, according as the demand might be for one or for the other of those uses. The alterations alluded to of Sheerness Dockyard, have *not* been made according to his plans. Indeed, had his proposals to Lords Spencer and St. Vincent been adopted, that dockyard, instead of being repaired, would, as it wore out, have been transferred to that far more eligible situation, the Isle of Grain.

The drain constructed by Sir Samuel (usually termed the Navy Well Drain) is now used as a reservoir to contain the condensing water for the steam engine, and to receive the small surface drains in that part of the dockyard.

"The site of this drain was originally a creek of the sea, the tidal water being penned in or out by a sluice or penstock, so forming a ditch for the drainings of the town and adjacent ground, the whole being a swamp, and about two feet below the spring tides. When the steam engine was erected for pumping the Navy Well, this ditch was the only place where water could be obtained for condensing. This drain was therefore constructed with suitable penstocks, to serve the double purpose of drain and reservoir; the whole length being about 1100 feet, 350 of which were not especially appropriated by a penstock for a reservoir to contain condensing water for the steam engine during low water. In consequence of that part of the town being taken into the new yard, one half or more of this drain was taken up to make way for the new buildings; but the remaining part is still used as a reservoir, and is being connected to the new drains and culverts; so, by means of suitable penstocks, the water is carried off or reserved at pleasure, thereby answering all the ends of its original purpose."

WEISBACH'S "MECHANICS OF MACHINERY AND ENGINEERING."—(VOL. II.)

In reviewing the first volume of this book (vol. xlvii., p. 494) we characterized it as being a work of indifferent merit in the original German, much damaged by the style in which it had been rendered into English. Of the second volume we are glad to be able to speak in more favourable terms. The first was stated to have been translated under the superintendence merely of Professor Gordon, of Glasgow; but the second is avowedly translated by the professor himself, and is all the better for the substitution of the master's for the "apprentice hand." The subjects, too, are of a higher order of interest, and, on the

whole, beter treated—though not so much so as to affect materially our general estimation of Weisbach as a writer on mechanics.

The present volume is divided into two parts. The first treats of "THE APPLICATION OF MECHANICS IN BUILDINGS," which includes "the equilibrium and pressure of *semi-fluids*"—the "theory of arches"—and "theory of framings of wood and iron;" the second of "MOVING POWERS AND THEIR EFFECTS," including the "measure of moving powers and their effects"—"animal power and its recipient machines"—"collecting and leading water that is to serve as power"—"vertical and horizontal water wheels"—"pressure engines"—and "windmills."

The reader will probably wonder what "the equilibrium and pressure of *semi-fluids*" (chap. 1), can have to do with the application of mechanics to *buildings*. He will please call to mind that the writer is a German, and that Germans have often queer notions of things. According to Professor Weisbach "*sand*, *earth*, *corn*, *seed*, *shot*, &c., &c." (whatever the two latter highly philosophical expressions may be supposed to comprehend) are but "*semi-fluids!*" The professor's reasons for this very novel and singular classification are these:

"They resemble fluids in so far as like these, they require external support that they may preserve a particular form. The mutual adhesion of the parts of semi-fluids is of course greater than in the case of water. Water always requires external support, while this is only the more frequent case with the so-called semi-fluids; and whilst water is in equilibrium only when its surface is horizontal, the disintegrated masses or semi-fluids in question, may be in stable equilibrium, though their surface be inclined." p. 1.

Shakspeare has been thought by critics to push the poetic license rather far when he bade the "sky rain potatos;" and our Hibernian brethren have been laughed at for boasting (in by-gone times, alas!) of their "mountains of butter-milk and rivers of potatos." But if Weisbach be right, it would seem to follow, that there is nothing in such flowers of speech, but what is perfectly consonant to good sense and sound philosophy.—As butter milk wants a can to hold it ("external support"), so do potatos want a pot to boil them in; *argal*, milk and potatos are substances *semi-ejusdem generis!*

It can hardly be necessary to state—though out of respect to Professor Weisbach and his translator we do so—that it is not true that "sand, earth," &c., require, like fluids, "external support that they may preserve a particular form." Witness the sand-hills on every shore, the mole-hills in every field, the piles of shot in every arsenal. Neither is it true that "the mutual adhesion of the parts" is "of course greater than in the case of water;" on the contrary, it is "of course," and of manifest necessity, just the reverse; of which fact the professor himself betrays a sufficient consciousness where he speaks of them as "*disintegrated* masses." In short, the semi-fluids of the professor are like to fluids for no one reason assigned by him; nor for any other reason worth a straw. Not a single property (except gravity) do they possess in common with the bodies they are said "to resemble."

In treating of the application in building, of these absurdly named materials, and in all he says relating to materials of construction generally, the author is exceedingly deficient. Professor Gordon tells us (p. 385) that "Professor Weisbach has treated this subject as it is usually given in elementary works on mechanics." We beg the professor's pardon; we know of no elementary work in which it is treated so meagrely and unsatisfactorily. Mr. Gordon himself admits that, "except as exhibiting approximately the laws of the phenomena, the 'Theory of the Strength of Materials' (Weisbach's) has many practical defects;" and to make up for those defects he (Professor Gordon) has put together (in an Appendix) what he considers "to be the *most valuable part* of our present knowledge on this subject to engineers or architects engaged in the erection of works"—of all which "*most valuable part* of our present knowledge" the original text contains confessedly nothing whatever! The Appendix referred to is a

most valuable paper—better, indeed, than any thing on any subject contained in the book itself—doing much credit to Professor Gordon, and in proportion as it does so, detracting from the pretensions of the Freiberg professor. We need make no apology for pausing awhile in our critical progress to extract a specimen or two:

Compression of Materials.

In prismatic pieces of *stone, wood,* or *cast iron,* which absolutely *crush* under a strain, *the strength is directly proportional to the transverse area of the piece.*

Pieces exposed to compression are not fairly *crushed,* but in some measure broken across, where their height is to their diameter or least lateral dimension in the case of,

Stone, more than as	6	to 1 ?
Wood, ,,	4	to 1
Cast iron, ,,	$3\frac{1}{2}$	to 1
Wrought iron ,,	$2\frac{1}{2}$	to 1

The manner in which materials yield under a crushing strain is very remarkable, as is exhibited by the experiments of Rondelet, Vicat, and E. Hodgkinson; the latter of whom has found, that the plane of rupture is always inclined at the same angle to the base of the column, when its height is within the limits above mentioned. The angle of rupture depends upon the nature of the material. In cast iron, for instance, it varies from 48° to 58° in different makes of iron, though confined to narrow limits for different prisms of the same make.—See "Report British Association," 1836, and Moseley's "Engineering," p. 550.

Table of the Resistance of Materials to Crushing,

		lbs. per sq. inch.
Granite, Scotch	..	10804 to 8184
——— Cornwall	..	6292
Sandstone, Dundee	..	6490
——— Derby	..	3110
Marble (white)	..	9583
Limestone (Portland)	..	6550
Stourbridge brick	..	1695
Deal, unseasoned	..	6780
—— seasoned	..	7290
Beech, unseasoned	..	7730
—— seasoned	..	9360
Oak, unseasoned	..	6480
—— seasoned	..	10000
Mahogany	..	8198
Larch, unseasoned	..	3200
—— seasoned.	..	5568
Poplar, unseasoned	..	3100
——— seasoned	..	5100
Cast iron, good common,		109800
———Stirling's toughened,		145500
Wrought iron	..	56000 ?

The effect of *seasoning* or drying timber, in increasing its strength, is never to be lost sight of. In wrought iron, a strain of 28,000 lbs. reduces the length, and causes a slight lateral bulging, corresponding to the slight reduction in length; that is to say, for a compressive strain of about three-fifths of the absolute crushing strain, wrought iron is quite "*crippled.*"

Stirling's process of *toughening* cast iron, consists in adding to it proportions of *malleable scrap,* varying according to the nature of the cast iron in its normal state.

Scotch hot blast, No. 1, will take 28 to 30 lbs. of scrap per cent.

Scotch hot blast, No. 2, will take 20 to 30 lbs. of scrap per cent.

Welsh and Staffordshire hot or cold blast iron require a less addition of scrap.

This process increases the strength of all cast irons, from 50 to 80 per cent.

Stephenson's Tubular Bridges—Fairbairn's Malleable Iron Girders.

Open cast-iron girders are bad in principle. Of all systems of framing girders or beams, the principle of perfect continuity of the component parts, involved in Mr. Fairbairn's patent *malleable iron girders,* is the best.

Without entering further into an examination of this subject, it appears to me that the present is a fitting place to give a concise account of the so-called "TUBULAR BRIDGES," now being erected by Mr. Robert Stephenson for crossing the Conway, and the Menai Straights on the line of the Chester and Holyhead Railway. The problem of passing both these points with the "Holyhead road," was solved by Telford in 1825, by the erection of the well-known Conway and Menai suspension bridges. Suspension bridges have been rejected as inapplicable to railways, and Mr. Stephenson has proposed, nay, has already completely settled the practicability of carrying out the *girder system* to meet the case. A girder to span 462 feet is an original and bold conception, and now that it may be said *to have been executed,* an attempt, if only imperfect, to sketch the progress of engineering art in the direction that has led to this master-piece, cannot but be useful.

The circumstances demanding or necessitating the erection of a bridge of great span, occur but seldom, and the double condition of erecting the bridge without centring, still more rarely.

The deep and rapid rivers of Switzerland, seem first to have called forth constructive skill for this purpose, in the year 1757, Jean Ulrich Grubenmann, born at Taffen, in the canton Appenzell, erected the celebrated bridge at Scaffhausen, over the Rhine, in lieu

of a stone bridge that had been swept away by the stream. In designing his bridge, Grubenmann took advantage of a rock about mid-way across, for the erection of a pier, to support the ends of two frames, or *compound girders of carpentry*, the one of 170 feet, the other 193 feet clear bearing or span.

In 1778, Grubenmann and his brother constructed the Wettingen bridge over the Limmat on the same principle that had guided them so successfully to the erection of that at Schaffhausen. This bridge had a clear span of 390 feet.

To Chretien von Michel, an engraver at Bale, we are indebted for the preservation of a record of the details of construction of those two bridges, viz. "Plans, coupes et élévations des trois Ponts de Bois les plus remarquables de la Suisse, publiés d'après les dessins originaux, Basle, 1803."

Both these bridges were burnt by the French in 1799,—the one having stood 42 years, the other 21 years. Over the one, stones weighing 25 tons each, had passed, and over the other a division of the French army with its artillery, in extreme haste. ("Emy, Traité de la Charpente.)". The points of construction in Wettingen bridge, to which we would direct especial attention, are:

1. The *continuity* of the framing, especially in its vertical plane, are as perfect as the nature of the materials allow.

2. The introduction of a *roof* as an integral part of *the constructive strength of the* bridge, and of the disposition of the greater *mass* of the timber towards the top and bottom, while the intermediate more slender part, or *rib*, is stiffened at every 15 feet by strongly framed uprights on the outside and inside. The timbers are laid nearly horizontally, accurately bedded on, and indented into each other, and bolted together by numerous wrought-iron through-bolts.

3. The circumstance that the two side frames of each were raised ready framed into their positions. This latter is an inference from the fact, that powerful *screw-jacks* placed on a scaffolding, supported on piles, ("des *verins* placés sur des échafaudages établis sur *pilotes*)" were used in raising the bridge at Schaffhausen, and that the Limmat, near the convent of Wettingen, is of great depth.

. . . .

At the period when the Wettingen bridge was erected by the Apenzell carpenter, the science of the strength of materials had scarcely begun to be formed, Galileo's theory, partially corrected by the hypothesis of Hooke and Leibnitz, and by the experiments of Mariotte and Buffon, began to attract notice; but our present knowledge of the mechanism of the transverse strain, resulting from the later experiments of Duhamel, Rondelet, and Barlow, and the theories founded upon them, were undeveloped. Yet we find the essential elements of these theories fully recognised in the construction of the bridges erected by the brothers Grubenmann. Art is the mother of science.

This was the largest bridge ever *erected* on Grubenmann's principle; but in 1772, there was exhibited at the Hôtel d'Espagne, rue Dauphine, a model of a bridge designed by one M. Claus for Lord Harvey. This was a model of a bridge 900 feet span, to be thrown across the Derry. The model was 20 feet long, or $\frac{1}{45}$ of the full size.

. . . .

Grubenmann's principle is adopted. The frames are here again nearly continuous. They consist of beams laid *nearly horizontal*, indented into each other, bolted together by innumerable long wrought iron bolts, forming the side ribs, and these were stiffened laterally by uprights. The floor and roof are so framed with the trusses or ribs, as to form one great double *box* or hollow girder, nearly every pound in the weight of which is available towards the absolute strength of the whole.

This bridge was never executed; but we see in it a still more perfect adoption of the plan of making the floor and roof a part of the framing, and also a recognition of the fact that wood has double the resistance to extension, that it has to compression; and hence the timbers of the upper part are arranged conformably to this fact. This was clearly recognized by Grubenmann, but not so perfectly worked out in the construction of his bridges, as was done by Claus. The introduction of a roof, as an integral part of the structure, is, of course, limited to cases in which the span is such as necessitates a *depth* of girder of 16 to 18 feet at least. The proportion of the depth to the length of the bridge of Wettingen is nearly $\frac{1}{15}$. (for further details of the construction of the model, *see* "Emy, Traitè de la Charpente, vol. ii., p. 398, and plate 134).

In Great Britain the problem of erecting bridges of wide span had scarcely ever been mooted, till about the beginning of this century, when the joint influence of the inventions of our Dudleys, Brindleys, Hargraves, Arkwrights, Smeatons, Watts, Corts, Wyatts, Mylnes, Rennies, Telfords, so rapidly developed the long latent industrial genius of the country, that in the short space of half a century, from being as low as any, we became the first in the scale of nations for perfection in internal communication, manufacturing skill, and in productiveness of the useful metals, especially *iron*.

In the year 1800, the subject of replacing Old London Bridge, occupied the attention of nearly every engineer of eminence, and of many men of acknowledged scientific attainments. At this period the success of the Wearmouth bridge, designed by Mr. Wilson in 1793, and erected in 1796 by Rowland Burdon, and of that of Builwash erected by Telford in 1796, seems to have drawn the attention of our most distinguished engineers to this material, as that best facilitating the execution of bridges of great span. The wonderful progress of the iron trade at this period, also, had its influence. The question of rebuilding London Bridge was shelved at this period; but Messrs. Telford and Douglass gave in designs for spanning the Thames by a single arch of 600 feet span, and the practicability of the design was supported by the opinions of Playfair, Robison, Watt, Southern, and others. In 1808—12, Staines Bridge was erected by Mr. Wilson, that of Boston by Mr. Rennie, and that at Bristol by Mr. Jessop. Vauxhall Bridge was commenced in 1813 by Rennie, finished in 1818 by Mr. Walker; the magnificent Southwark Bridge was erected 1814 to 1818 by Messrs. Rennie, father and son.

The principle of construction adopted in all these, was that of the *arch*. The cast iron was framed so as to render the structure as strictly analogous to that of an arch of voussoirs as possible. We shall here only notice that the adoption of this principle, involves a prodigious expenditure of cast iron, to insure the lateral stability, essential in the voussoir principle, beyond what is necessary for the vertical strength required to bear the load.

The use of cast iron as the framing of machinery, floor-girders, lock-gates, swivel-bridges, &c., &c., became more and more usual in the construction of works executed after 1808, at which period Brunel, by demonstrating the practicability by using cast iron as the framing of his block-machinery, gave new confidence in adopting the recommendation of Smeaton, on this subject, made 50 years earlier.

In 1817, Barlow's Essay on the "Strength of Timber, Iron, and other materials," was published, and English engineers were thus put far on the way of making "principles of science rules of their art." A few years afterwards, Tredgold's Essay "On the Strength of Cast Iron and other Metals," was published, and this remarkable work—of a most remarkable man, together with Barlow's work, had—all engineers will admit—a powerful influence in extending the rational use of iron in construction. Ten years later Mr. Eaton Hodgkinson, of Manchester, began a course of inquiry on the strength of iron, which, while it has earned for him and his coadjutor, Mr. Fairbairn, a high reputation for scientific knowledge and skill, has even more directly than the earlier works mentioned, contributed to the present important position of iron as a material in construction.

During this period, too, our dependence on Russia and Sweden for malleable iron was put an end to, by the improvements and vast extension of our Welsh and Staffordshire rolling-mills, which, towards 1810, began to stock our markets with iron, equal for all ordinary purposes to that which, up to this period, had been chiefly supplied by foreigners.

It is a distinguishing element in the engineer's art, to adopt the material best suited, economically speaking, to the work he has to accomplish.

In 1806, the price of bar iron, larger size, was 20*l.* per ton: in 1816, it was 10*l.* per ton; 1828, it was 8*l.* per ton; and in 1831, it was 5*l.* to 6*l.* per ton.

Thus this material has gradually come into the domain of applications in construction, from which its high price had long excluded the consideration of its qualifications. Roofs of great span began to be formed of combinations of cast and malleable iron. The eligibility of the one to resist strains of compression, and of the other to resist tensile strains, became familiar to those engaged in practical construction.

In 1825, a new engineering era had arisen. As the genius of Brindley, under the mighty influence of the policy of a Chatham, had created our inland navigation, the genius of a Stephenson, under the influence of the policy of a Huskisson, created the railway system. Steam navigation advanced from mere essays to a system of vast importance. The demands of the ship builder, the locomotive maker, and the railway engineer, gave rise to new exertions of the iron masters. Blooms were puddled of sizes hitherto deemed impracticable. It became usual to have bars rolled, and pieces forged of sizes exceeding those which, within a few years, had been deemed wonderful or isolated examples. In this respect, the complacent dictum of a celebrated engineer, that "no difficulty can arise in engineering or mechanical art, that is not certain to be overcome," has been fully borne out.

In the construction of the London and Birmingham Railway, the Great Western Railway, the Midland Counties Railway, and others, the engineers made ample use of cast iron, and examples of girders of 50, 60, even 70 feet in length are to be found on these lines of railway. The scientific principles of construction of such girders were

not at once recognised or learned, and we consequently find excess of iron in most instances, and mistaken construction in others. There was no time for gathering exact knowledge, though extant. A limited experience of successful cases led to endless repetitions of girders of not very happy proportions, and "trussed" in the wrong direction. The outcry made in England on the subject of hot blast iron being so inferior in quality, so treacherous, &c., &c., the consequent high price demanded for castings of what was termed good iron, had considerable influence in limiting the applications of iron in railway bridges. Stone and brick were preferred for the few bridges of great span erected. Suspension bridges were tried, and failed. Of the wooden bridges erected, that over the Tyne at Scotswood, by Mr. Blackmore, deserves mention as involving the best principles of construction. The path so well opened up by Grubenmann had long been lost. The System of the Bavarian engineer, Wiebecking, and applied by him successfully to the bridge of Bambery, 215 feet span, and others, were extensively made known by his published writings, whilst the better principle of Grubenmann was overlooked. The essential part of Wiebecking's system consists in putting the main *strength* of the frame in arches of curved timbers trenailed together, on to which the rest of the timbers of each truss is framed, *suspending the horizontal ties*, from which the road-way is supported. Wiebecking's system, with certain modifications, was adopted in France by M. Emmery, about 1830, and by the Messrs. Green, of Newcastle, about 1840. In imitation of Wiebecking's plan too, the *bow and string* fashion of open cast-iron girders was adopted, small as is the analogy between *wood* and *iron*. Beginning with the bridge over the Regent's Canal at Camden Town, this fashion of girder has been many times repeated, on various scales; and is in execution even at the present moment, for spans of 120 feet, in the high level bridge at Newcastle-upon-Tyne.

In the mean time in America, Town's lattice frame bridges, and Long's diagonal frame bridges, had been invented, and railway bridges of 150 to 180 feet clean span, had been executed according to each system. In the largest application of Long's system, the depth of the frame is about 20 feet, and the sides and floor, and roof are connected together, so as to form one *box-like girder*. The diagonal framing, even when carried out in the form of lattice work, makes but an imperfect continuity in the framing, or ribs connecting together the top and bottom rails and flanges; but this is *the principle* aimed at, and the bridges are to be considered as very successful engineering. They have been adopted in this country in a few cases, the largest being that of an occupation bridge on the Birmingham and Gloucester Railway; but wooden structures are to be avoided in this country, on account of the extreme variations in the hygrometric state of our atmosphere.

Of the many lattice bridges erected in America, the most interesting, in reference to our subject, is the iron tubular lattice bridge in the great hotel, Tremont House, at Boston. This is *an elliptical tube of lattice or trellis-work*, the height being 7 to 8 feet, the minor axis of the ellipse being 4′—6″, the span about 120 feet. The top is stiffened by a longitudinal bar. The flooring of wood on the bottom, is about 3 feet 6 inches wide, and helps to stiffen the whole. This foot bridge had been several years in use in 1843, and its perfect rigidity, it may be here mentioned, at once suggested to our informant's mind, though not an engineer, the applicability of the plan for carrying a railway across the Menai Straits.

Among the circumstances concurring to the result consummated by Mr. Stephenson, the success of iron ships of enormous dimensions, in resisting the strain they have to undergo, is certainly a prominent one. The *Great Britain* steam ship, for example, is 253 feet in length. It is mainly composed of sheet and angle iron, of less than half an inch in thickness; it is thus, like other iron ships, a mere shell, and yet from its perfect *continuity*, and the nature of the materials, has, unimpaired, withstood lateral strains under which a vessel on almost any other construction must have broken up.

Such was, as I conceive it, the state of preparation of engineers' minds for solving the problem of carrying a railway across the Menai Straits by girders, when early in, 1845, Mr. Stephenson's "aërial tunnel" was spoken of. On the 5th of May, 1845, he announced his plan before a committee of the House of Commons.

Few inventors can explain the development in their minds of an original conception. Invention in art consists of two distinct intellectual efforts—first, in seizing the ideal conception of the object to be made for a given end; and, second, in the contrivance of the suitable arrangement of materials (or of mechanism in the case of a machine) for that object. The nature of the first conception seems always to depend on the existing state of analogous objects, and hence the two parts of the process are generally intimately connected, though not

inseparable. In Mr. Stephenson's case, the two processes seem to have been separated. For as early as April 1845, Mr. Eaton Hodgkinson and Mr. Fairbairn seem to have been consulted as to experiments on the strength of cylindrical tubes of riveted sheets of iron, and as to the necessity of a combination of the girder plan with suspension chains, for his great bridges. We learn from a communication of Mr. Hodgkinson to the mechanical section of the meeting of the British Association, held at Southampton in 1846, "that a number of experiments were made upon *cylindrical* and *elliptical* tubes, and few upon rectangular ones;" but inasmuch as a girder has to resist in its vertical direction much more than in its horizontal the oblong rectangular form should have immediately suggested itself as the best; and therefore these first experiments were works of supererogation.

Mr. Hodgkinson's experiments were, therefore, at once directed to ascertaining what should be the distribution of the metal in hollow rectangular girders, to secure a maximum of strength with a minimum of weight. Mr. Hodgkinson, whose investigations, published in 1840, had proved experimentally that hollow columns have a greater resistance to compression than the same weight of material in a solid column (as the usual theory had indicated, and the practice of Wiebecking and Gauthey thirty years earlier, and of Polonceau in 1839, had testified), now made further experiments to ascertain the relative resistance of circular and rectangular tubes, with the object of disposing of the malleable iron, of which the girders were to be made in this hollow form, on the upper side, *i. e.*, the part *compressed* by the strain.

As might have been anticipated, the "*buckling*" of the plates on the top had to be prevented by particular contrivances, or by greatly increasing their substance beyond that of the bottom or extended side.

The following are some of the leading results of Mr. Hodgkinson's experiments.

Experiments on two similar tubes:

Length of tube.	Weight of tube.	Distances between supports.	Depth of tube.	Breadth of tube.	Thickness of metal in 16ths of an inch.			Breaking weight in tons.	Ultimate deflexion.
	cwt. qu.		feet.		Top.	Bottom.	Side.		Inches.
31'–6"	20–3		2	1'–4"	6	4	2	26,1	2¼
47–0	61–1	45	3	2'–0	9	6	3	65,5	3⅜

This breaking weight in tons is in *excess* of the results deduced from the usual formula, when the value of I (the moment of inertia) is calculated by our formula 5 (p. 393), when f^1 is taken = 56,000. To ascertain the power of such tubes to resist a lateral strain—as from the action of wind—the smaller of these two tubes, after being well repaired, was laid on its side and broken. The mean of two experiments gave 15,2 tons as breaking weight, which is about 25 per cent. above the result of calculation by our formulas, when the value of f^1 is taken as indicated. Experiments on the strength of sheet iron, however, give tensile resistance as high as 62,000 lbs. per square inch, and if we introduce this as the value of f^1, the experimental results would almost exactly correspond with the received theory.

Mr. Hodgkinson's experiments on the resistance of sheet iron tubes to compression, show, (as his experiments on cast iron columns made in 1839 had previously done, and as Euler's theory indicates) that rectangular tubes are weaker than square ones, and both of these much weaker than cylindrical tubes; so much so indeed, *that the substitution of cylindrical for square or rectangular tubes, would*, according to Mr. Hodgkinson's experiments, *effect a saving of one-fourth of the metal in the top.*

Mr. Fairbairn, at the same meeting of the British Association, September 1846, made the following communication of "Experiments on Tubular Bridges, proposed by *Mr. R. Stephenson*, for crossing the Menai Straits: "These experiments, says Mr. Fairbairn, have put us in possession of facts, which greatly increase our knowledge of the properties of a material, whose powers, when it is properly put together, are but imperfectly understood; for exclusive of the rapidly increasing use of wrought iron in the construction of ship-boilers, &c., its application to bridges of the tubular form is perfectly novel, and originated with Mr. Robert Stephenson. Experiments of the most conclusive character were those made on a model tube on a large scale, containing nearly all the elements of the proposed bridge, and the various conditions with regard to form and construction, which had been developed by the previous inquiries (above alluded to). It occurred to Mr. Fairbairn that the strongest form would be that wherein the top and bottom section appeared of a series of pipes, with riveted plates on

their upper and under sides. This form of top, says Mr. Fairbairn, would possess great rigidity, and is well adapted to resist the crushing forces to which it is subjected; and the bottom section appeared equally powerful to resist tension. Mr. Fairbairn thought that this is the strongest form that could be devised; but practical difficulties present themselves in its construction, as an easy access to the different parts for the purposes of painting, repairs, &c., is absolutely necessary. The scale of the model tube was exactly one-sixth of the length, breadth, depth and thickness of metal of the bridge intended to cross one span of the Straits, 450 feet, (since increased to 462 feet.) In each of the experiments, the weights were laid on at the centre, about one ton at a time; and the deflection was carefully taken as well as the defects of elasticity after the load was removed."

Of the second part of Professor Weisbach's present volume, the best and most original part is that which treats of "horizontal axle wheels," or, as they are more commonly designated, TURBINES; nowhere, will the reader find such complete details of the construction and performances of this interesting class of engines, or their respective merits more rigorously investigated and fairly appreciated. Of the three most prominent—Fourneyron's, Cadiat's, and Whitelaw's—he gives this estimate:

The turbine with guide-curves (Fourneyron's) is unquestionably the more perfect construction, mechanically considered, as by this arrangement the entire *vis viva* of the water may be taken from it, which cannot be done without this apparatus. All things considered, the velocity of rotation for all the wheels is nearly the same for the maximum effect. This maximum effect is nearly the same for each of them, the advantage being on the side of Fourneyron's wheels, when working in its normal state, and on the side of Whitelaw's, when the supply of water is very variable. The Scottish turbine may be constructed at less cost than Fourneyron's turbines with guide-curves. In general terms, we believe that the turbines of Fourneyron and Cadiat are better adapted for very low falls and those of moderate height (up to 30 feet) with large supplies of water, whilst for high falls and small supplies of water, Whitelaw's wheels are to be preferred.

In an Appendix to this part of the book, Mr. Gordon gives an account of a water-pressure engine, which was erected, in 1845, at the Alport Mines, in Derbyshire, by Mr. Darlington, and has been attended with extraordinary success:

The average speed of the engine is 140 feet per minute, or 7 double strokes per minute. This requires a velocity of something less than 2¼ feet per second of the water in the pressure pipes; and as all the valve apertures are large, the hydraulic resistances must be very small. The engine is direct acting, drawing water from a depth of 135 feet. The "box," or *bucket* of the pump is 28 inches in diameter, so that the discharge is 266 gallons per stroke, or when working full speed, 1862 gallons per minute. The mechanical effect due to the fall and quantity of water consumed is nearly 140 horse power. The mechanical effect involved in the discharge of the last-named quantity of water is nearly 74 horse power, so that supposing the efficiency of the engine and pumps to be on a par with each other, the efficiency of the two being $\eta_1 = 71{,}15$, the efficiency of the engine alone,

$$\eta = \frac{1+\eta_1}{2} = \frac{1+{,}71}{2} = {,}85,$$

or, in the language of Cornish engineers, 85 per cent. is the duty of the engine.

The cost of maintenance, grease, &c., of the engine, is only £40 per annum. In every particular it redounds to the credit of Mr. Darlington's skill as an hydraulic engineer.

To the two volumes of Weisbach which we have thus passed under review, Mr. Gordon promises to add hereafter a third of his own, which is "to comprehend a 'Treatise on the Steam Engine,' or, what more exactly expresses the subject matter, 'On the Motive Power of Heat,' *that shall be complete in itself, and in accordance with the general design of Mr. Balliere's admirable series of standard scientific works.*" (These Italics are Mr. Gordon's own.) The consistency of making that a supplementary volume of Weisbach, which is at the same time to be "complete in itself," is not very apparent. If so "complete in itself," Mr. Gordon had better publish it by itself. It will be a good work, no doubt, and Mr. Gordon should not mar its fair prospects of success, by tagging to it so much German ponderosity. If it be expected that, by coupling the two works, *Weisbach by Gor-*

don may take the rank in this country of a standard work on "The Mechanics of Machinery and Engineering," we feel tolerably certain that the speculation will prove a failure. *Gordon without Weisbach* would have stood a much better chance. All that Mr. Gordon can do by way of note, or comment, or addition, to mend the work of the German Professor, will never make it more than a very common-place book, and one which we, in this country, could have done very well without. To Moseley's "Engineering and Architecture" it cannot, as a whole, be for one moment compared; nor even to the older works of *Gregory, Young, Robison, and Emerson.* The "Theoretical and Practical Mechanics," published last year by Mr. Hann (an excellent work), and the valuable series of "Rudiments," in course of publication, by Mr. Weale, might also be cited as proofs, that England has scientific writers of her own, fully equal to the supply of whatever text books are needed, for the instruction of her people in mechanical philosophy.

GUTTA PERCHA PATTERN BOOK.

The Gutta Percha Company have just published, in imperial folio, for the use of "upholsterers, cabinet and picture-frame makers, decorators, and others," a very splendid book of ornamental patterns. Of the superior suitableness of gutta percha for mouldings of every description, the public, we believe, are already well aware. For precision and softness combined, the casts in this material equal, if not surpass, the finest specimens of the Berlin ironfoundries. The engravings are mostly of the full size of the originals, and numbered, in order to facilitate the giving and execution of orders. The designs are generally new, and some of them exceedingly beautiful.

The Company promise to publish, in succession, "a variety of new designs adapted to the various branches of the decorative arts," and to endeavour also to supply the articles themselves, "at a price which will ensure their general adoption."

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING FRIDAY, MARCH 23.

HENRY WILSON, foreman to Messrs. William Greaves and Son, Sheaf Works, Sheffield. *For improvements in the manufacture of chisels and gouges.* Patent dated Sept. 21, 1848.

The patentee remarks that it has hitherto been customary to make chisels and gouges with either sockets or tangs, to which the handles are fitted, according to the kind of work for which they are to be employed, so that when the workman passes from one kind of work to another, he must change the tool; and that the "socket chisel" is subjected, when in use, to great lateral pressure, which often causes it to break; while the handle of the tang chisel, although confined by a ferule, is liable to split. Now the present invention consists in forging, brazing, or otherwise fastening the tang inside the socket by any suitable means, so that the handle is fitted into the socket and on to the tang, and the use thereof combined in one tool, which is thereby rendered stronger.

Claim.—The manufacturing of chisels and gouges with tangs and sockets combined.

JOSEPH LILLIE, Manchester, engineer. *For certain machinery or apparatus applicable for purifying and cooling liquids, and for purifying, condensing, and cooling gases.* Patent dated Sept. 21, 1848.

The invention sought to be secured under this patent consists—

1. Of an apparatus for dispersing, by centrifugal force, a mass of liquid in minute particles, so as to expose it to the atmosphere or artificial currents of air. A bowl is perforated with numerous holes a short way from the bottom, or formed of wire gauze, and has the edges bent inwards, to prevent the liquid from flowing over. A vertical shaft, which passes through the centre of the bowl, is stepped in the bottom of a suitable receiver, and carries at top, above the bowl, a fast and loose pulley, the spindle of which is driven by an endless band from a steam engine or other prime mover. The liquid to be cooled, is conducted from the source of supply by a pipe, fitted with a stop-cock, to regulate the inflow of the fluid. On rotary motion being communicated to the bowl, the liquid will creep up the sides, and be ejected, in fine streams, through the perforations, into contact with the atmosphere or artificial currents of air, and thereby cooled. The bottom of the receiver may be perforated, and have a vessel underneath to contain the liquid, which will thus be kept separate from the heat and vapour of the fresh liquid. The heat and vapour is drawn off by means of an inverted funnel, having a horizontal pipe attached to the small end, which is furnished with a chamber and fan for condensing the liquor in the ordinary way, or driving it out into the atmosphere as waste. With an apparatus having a vertical fall of eight feet, and the bowl making 400 revolutions a minute, the patentee has reduced the liquid from a boiling point to just above that of the atmosphere.

2. An arrangement of apparatus for effecting the same object as in the preceding case, but by means of pressure, consists in making the vessel or bowl a fixture, and conducting the liquid thereto by means of a pipe leading from a reservoir placed sufficiently high above the bowl to obtain the requisite degree of pressure to eject the liquid at the required angle to the ground.

3. The apparatus for "purifying, condensing, and cooling gases," consists of a square close vessel, in which a mixture of water and lime is dispersed, as described under the second head. It is furnished with a false bottom perforated all over, with the exception of a space in the centre somewhat larger than the circumference of the induction pipe. The gases are brought by this pipe from the source of generation underneath the unperforated portion of the false bottom, and pass through the perforations, in a finely divided state, up among the streams of lime and water, which will condense the ammoniacal vapours, the sulphuretted hydrogen, and carbonic acid. The gases thus purified, condensed, and cooled, escape through an eduction pipe fitted to the top of the vessel, into a gasometer.

4. Another method of purifying, condensing, and cooling gases, consists in introducing them into the vacuum created in a mass of liquid by the revolution of a hollow tube therein. The purifying liquid is placed in a close vessel fitted with an eduction pipe placed in the top of one of the sides. A vertical hollow shaft is suspended in a stuffing-box in the top of the vessel, and furnished at the top with a loose and fast pulley, by which it is made to rotate through the intervention of an endless band from any prime mover.

The part of the hollow shaft which projects above the pulleys passes through a stuffing-box into the pipe that conducts the gas from the source of generation. Two short hollow pipes are fitted at right angles to the lower part of the vertical shaft, just above the bottom of the vessel. The free ends of the short tubes are slightly bent in reverse directions. On rotary motion being communicated to the shaft, a partial vacuum will be created by the revolution of the short horizontal tubes, and the gases thereby drawn down and ejected into the centre of the liquid, whence they will pass out through the liquid to the top of the vessel, and escape by the eduction pipe into a suitable reservoir.

5. A combination of the first and fourth apparatus, before described, is effected by the following arrangement. The vertical shaft which supports the bowl or vessel is made hollow and closed at the lower end, which rests on the false bottom of the receiver while the top projects above the driving pulleys, and opens through a stuffing-box into the supply-pipe. Two short hollow tubes, open at the ends, are fitted at right angles to the bottom of the vertical shaft. When the vertical shaft is made to revolve, the gases will be drawn from the source of supply, and impelled through the short hollow tubes against the sides of the falling streams of fluids, whereby they will be purified, condensed, and cooled.

Claims. 1.—The revolving bowl or vessel pierced with numerous small holes, through which the liquid to be cooled is impelled by centrifugal force in a divided state.

2. The combination of apparatus whereby the liquid is subjected by centrifugal force in a divided state to the action of artificial currents of atmospheric air or other gaseous bodies.

3. The arrangement of apparatus for subjecting the liquid in a divided state by pressure, to the action of the atmosphere, or to artificial currents of atmospheric air, or other gaseous bodies.

4. The purifying, condensing, and cooling gases by subjecting them to the influence of a liquid distributed in a divided state.

5. The apparatus for purifying, condensing, and cooling gases, whether used alone or in combination with the centrifugal distributor.

JOHN FREARSON, Birmingham, machinist. *For improvements in bending or shaping iron or steel, or other metals.* Patent dated Sept. 21, 1848.

The metal to be operated upon is supplied while hot from between the rollers, by which it is formed, and drawn by tongs which have a to-and-fro and closing-and-opening motion communicated to them, between a pair of cutters, and slantwise across a mandril or die. The requisite length is cut off, and then drawn by the mandril between a pair of grooved rollers, which are supported in the ends of two levers, and placed, not in the same right line, but side by side. As the iron is drawn through, the rollers are caused to approach by cams acting upon the free ends of the levers, which will have the effect of bending it completely round the mandril. The link, when completed, is removed by the mandril being made to slide back, and by the forward action of a catch interposed between the link and sliding plate in which the mandril is supported. The different parts are worked from the main shaft by an arrangement of cams and levers, far too complicated to be described intelligibly without reference to diagrams.

A nail or pin-making machine is described, which consists of a bed-plate, the face of which slopes down from the centre towards the sides, whereby a ridge is formed in the centre which

rises gradually from one end to the other; above this the top plate travels in grooves, and has its under face formed so as to slope up from the centre towards the sides. A piece of iron, equal to the length of two pins, is placed upon the bed-plate, and the top plate made to travel from end to end, whereby the iron is formed into two cones, and, as the space between the centre ridges gradually decreases, it is finally separated into two pieces.

The patentee claims six different apparatuses as represented in drawings which accompany the specification.

WILLIAM BROWN ROOF, Stanhope-street, Regents Park, chemist. *For certain improvements in the construction of respirators.* Patent dated September 21, 1848.

Mr. Roof's improved respirator consists of a crescent-shaped case of silver or other metal having a valve box in the face plate, or part opposite to the mouth, which opens inwards, and perforations in the outer side for the admission of fresh air through the valve-box to the lungs. The interior of the case is divided by two horizontal partitions into three compartments, the centre one of which is by far the largest of the three, and contains a number of vertical tubes, which are supported in the two partitions. Holes, furnished with valves opening outwards, are made in that part of the face plate which opens into the top partition. When the patient breathes the valve box closes and the warm air passes through the openings into the top compartment, and escapes down the metal tubes through the lower compartment into the atmosphere, and imparts a considerable portion of its heat to them. When he inhales, the valved openings in the top compartment are closed, and the valve-box opposite the mouth is opened; the pure air enters by the inlet holes, and circulates among the vertical tubes, whereby it is partially heated before it passes through the valve-box to the lungs. The edges of the face plate are padded so as to fit closely around the mouth, and prevent the entry of cold air.

Claim.—The constructing of the respirator, so that the vitiated or expired air may be conducted away without mingling with the pure air to be inhaled, through metal channels, and made to impart heat to the pure air by its passage through them.

American Edition of the Electric Light.—Mr. Henry M. Paine, of Worcester, Massachusetts, informs the *Scientific American* that he has discovered a means of generating light by mechanical action, from water and lime. Mr. Paine says, —" I have continued the experiment at intervals, and I am now enabled to announce a successful result. I have produced a light equal in intensity to that of four thousand gas burners of the largest bat's-wing pattern, with an apparatus occupying four square feet of room, at a cost of one mill per hour, the current of electricity being evolved by the action of the machinery wound up with a common lock key, and the only materials consumed are water and lime. I am now engaged in making an apparatus for public exhibition, which will be completed this winter, and all its parts submitted to public inspection, except the interior of the generator. This apparatus I will exhibit one year, at the end of which I will make public the mechanism of the generator."

WEEKLY LIST OF NEW ENGLISH PATENTS.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in the manufacture of piled fabrics. (Being a communication). March 19; six months.

Joseph Beranger, of the firm of Beranger and Co., of Lyons, France, civil engineer, for improvements in weighing machines. March 19; six months.

Thomas Henry Russell, of Wednesbury, patent tube manufacturer, and John Stephen Woolrich, of Birmingham, chemist, for improvements in coating iron and certain other metals and alloys of metal. March 19; six months.

Samuel Hall, of Kings Arms Yard, Coleman-street, London, civil engineer, for improvements in apparatus for effecting the combustion of fuel and consuming smoke, and for preventing explosions of steam boilers and other accidents to which they are liable. March 19; six months.

George Knox, of Moorgate-street, London, Secretary to the Shrewsbury and Birmingham Railway Company, for improvements in railway carriages. March 19; six months.

Alexander M'Dougall, of Longsight, Lancaster, chemist, for improvements in recovering useful products from the water used in washing and in treating wool, woollen, and cotton fabrics, and other fabrics. March 20; six months.

William Harrison Pickering, of Liverpool, merchant, for improvements in evaporating brine and certain other fluids. (Being a communication.) March 20; six months.

Charles William Siemens, of Birmingham, engineer, for certain improvements in engines to be worked by steam and other fluids, and in evaporating liquids. March 20; six months.

William Parkinson, of Cottage-lane, City-road, Middlesex, gas-meter manufacturer, successor to the late Samuel Crosley, for improvements in gas and water meters, and in instruments for regulating the flow of fluids. March 20; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subject of Design.
March 17	1815	Thomas Eldrid	Fore-street, Cripplegate	Sandwich-case.
"	1816	John Fernihough and Sons	Duckinfield	Steam boiler.
"	1817	W. and A. Munro	Edinburgh	Locking wheel.
"	1818	Henry Smith and Thomas Willey	Liverpool	Switches for tram railroads.
20	1819	John Young	Wolverhampton	Lock sash-fastener.
21	1820	Joseph Sayce	Cornhill	The plumb coat.

NOTICES TO CORRESPONDENTS.

A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the Claims of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d. Post Office Orders to be made payable at the Strand Office, to Joseph Clinton Robertson, of 166, Fleet-street.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1338.] SATURDAY, MARCH 31, 1849. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

SIR GEORGE CAYLEY'S WORKING MAN'S ARTIFICIAL HAND.

Fig. 2.

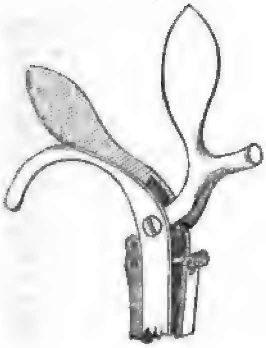


Fig. 1.

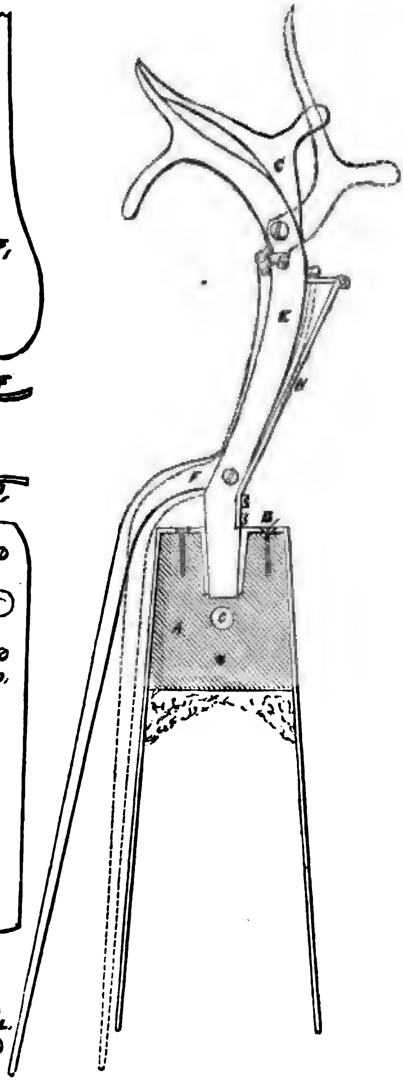
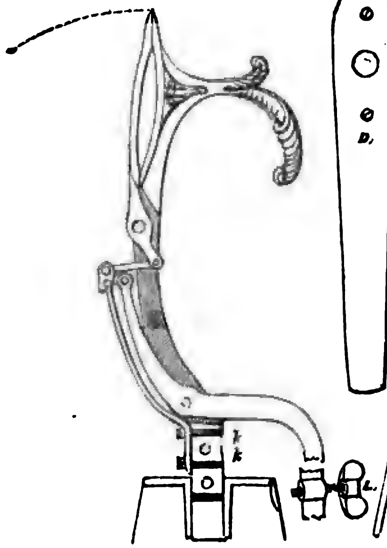


Fig. 3.



DESCRIPTION OF AN ARTIFICIAL HAND FOR WORKING MEN. BY SIR GEORGE CAYLEY, BART.

Sir,—As I know you are a friend to the labouring classes, I send you the plan of a sort of iron or steel *claw*, as a middling substitute for a hand, when that limb is wanting. You have been kind enough to insert, in several former Numbers,* notices respecting artificial hands effecting in some measure the movements and appearance of the human hand; and such is the dislike to acknowledge any personal defect, that many persons of leisure will prefer wearing even the semblance of a hand, without any movement, to such an instrument as I am about to describe, which certainly is not ornamental, but appears to be very useful. Those hands formerly described were fastened to the upper arm, and derived their working powers from that connection; but it is found that this entails too much trouble on the wearer or his friends, and that they are apt to be neglected, except on special occasions.

Although the grasp of the artificial hand is sufficient for several purposes, yet it is encumbered by its unnecessary bulk, and not so good an instrument as the one I now send you a sketch of, which can be made at a very small cost, and put on the stump by the wearer himself without difficulty. A simple hook attached to the stump has long been worn by persons of the working class: it enables sailors to climb the rigging securely, horsemen to hold the bridle, the labourer to handle the spade and the wheel-barrow, &c., &c. I have merely added a voluntary grasp to this old and useful instrument, and the means of pushing objects forward securely, or towards either side.

A, fig. 1, is a truncated cone of wood, which forms the bottom of the stiff leathern receptacle for the stump; B, an iron socket, screwed to the exterior end of the block, for the purpose of receiving any instruments the wearer may choose to place in connection with his stump, as a knife, saw, file, pen-holder, &c., and also to hold the general instrument represented in fig. 1. These are firmly retained in the socket by a spring catch, similar to that so frequently used for fixing a variety of tools to one handle. The thumb-piece of the spring catch works through the aperture, C.

To give firmness to the leather surrounding the stump, two pieces of thin curved steel are screwed on to the block on the upper and under side, and covered by thin leather, neatly stitched to the stump core. D represents the upper of these steel pieces. The hook stem, E, is cut through for the greater part of its length, so as to leave sufficient space for the short end of the lever, F, and a part of the forceps, C, to work within it. This will be best understood by looking at a similar part of a left-hand apparatus, Fig. 3, where one side of the hook stem is cut away on purpose to show the work which is partly concealed by it in fig. 1. It may also be further explained by the perspective drawing of a part of fig. 1, shown in fig. 2.

The longer end of the lever, F, fig. 1, is kept about one inch and a half from the external case of the stump when it approaches the elbow by a strong spring, H, the end of which is connected by a short bridle with the shorter end of the lever, F. Of course, when the longer end of this lever is brought into the position shown by the dotted lines, by being pressed against the side of the wearer, the spring is more bent, and exerts its force to restore the lever to its former position under the sleeve of the wearer, which is made wider than usual towards the elbow, to receive and conceal it. The shorter arm of the forceps, C, is also connected with this spring by a similar bridle; and the dotted lines show the action in which the forceps becomes opened about three inches at its extreme points.

By relaxing the pressure of the elbow against the side, any object of suitable size becomes grasped, and remains so till released by a renewal of the pressure.

The mouth of the forceps is grooved, as seen in fig. 2, to give it a firmer hold, and is of considerable breadth, and of a long oval form. The spring, H, is about the strength of the main spring of a gun lock, and requires a pressure of, say ten pounds at the end of the lever, F, against the body of the wearer. As the points of the forceps go over double the space of the movement of the lever, the pressure of the spring, which causes the grasp, is about five pounds when closed; and when opened to take in objects, the

* Vol. xlii., pp. 152, 174, 192, 198, 217.

pressure increases with the size of the article to be grasped.

To prevent too rapid an increase in the force of the spring, the short arm of the forceps, to which the bridle is attached, is bent into the position seen in fig. 3, so that as the forceps open, although the spring keeps increasing in power, it is operating against a continually diminished leverage. To preserve the end of the sleeve from falling flat, which has an ugly appearance, a thin hoop may be fixed by a stem in front of the stump-block, or screwed to the shank of the hook through the holes, *k k*, fig. 3.

The whole instrument, fig. 1, which was purposely made for strong work, weighed one pound and eleven ounces; and the wearer's hand and part of the arm lost, measured by the overflow of water from a full vessel, on the other hand being inserted, would have been one pound five ounces, so that the excess of weight was, in this extreme case, only six ounces. If these instruments were made in steel, in lieu of iron, they need not exceed a pound in weight, even for strong work.

The instrument made on the plan of fig. 3 was lighter, but the record of its weight was lost.

To give an example of the use of the forceps in addition to that of the hook, the wearer of that on the plan of fig. 3, had no sooner got it on, than he took up from a smooth table, in succession, eight pieces of coin, consisting chiefly of sixpences, and placed them one over the other on the top of a slender chip box, made for lucifer matches, without difficulty, and when the least irregularity in the movement would have upset the box. Pins and needles were readily picked up from the table; and larger matters, such as candlesticks, &c., were handed about, and deposited in any required position.

There is one inconvenience attending this instrument—as the forceps are opened by pressing the elbow against the side, the range of the arm in front is only extended to the fore arm, aided a few inches by the bend of the body forward. When, however, the object within this range has been grasped, the whole arm can then be extended with the object held firm by the spring; but to release it, it must again be withdrawn to the limit of the fore arm, unless the other hand be at liberty, by compressing the lever, to release it at the whole extent of the arm. It would require a long string of these dry matters fully to explain the uses of this instrument, but I have furnished your valuable pages, and some of your readers, with quite enough already.

Should any one be so fond of the *appearance* of a hand as to wish to encumber the forceps with mimic fingers and thumb, this can readily be done; and probably many will prefer this to the more elaborate structures formerly described, and in which almost every movement of the hand was successfully imitated by the ingenuity of Mr. Buckingham, in carrying out the principle I had suggested.

It seems almost needless to notice that these stump cases are held in their place, as usual, by a strap passing twice round the upper arm joint above the elbow, and buckled in front to the case.

I am, Sir, yours, &c.,
GEORGE CAYLEY.

P. S.—My friend, Mr. Goldsworthy Gurney, has suggested what I think a valuable improvement to this instrument—which is to employ some means of rendering the grasp of the forceps more forcible and permanent when occasion may require it. I would suggest for this purpose a thumb screw, L, fig. 3, to press against a plate on the stump case, and thus convert the forceps into a vice at any degree of its range.

DAVIES'S ROTARY ENGINES.—"A. Z." IN REPLY TO MR. DREDGE.

Sir,—I beg to be allowed a few words, in reply to Mr. Dredge's letter in the *Mech. Mag.* of the 10th inst.; and, in the outset would observe that both you and Mr. Dredge appear to have mistaken the object of my former letter, which was not, as you seem to suppose, to enter into the comparative merits of reciprocating and of rotary engines in general, but to examine how far Davies's rotary engine was entitled to be considered an improvement upon preceding rotary engines. This explanation renders it unnecessary for me to enter into Mr. Dredge's long calculation of the comparative amounts of the *vis inertia* to be overcome in Davies's engine and in reciprocating engines—otherwise it would not be difficult to show that the calculation is not altogether fair to the reciprocating engine. Passing on, therefore, to the other points of Mr. Dredge's letter, I find, in the first place, that I was

mistaken in supposing that the slide moved under pressure, as it now appears that the slide and piston are both in equilibrio from the moment the slide begins to move. I fell into this error from the consideration, that it is evidently desirable, that the action of the steam upon the piston should be maintained through as great a portion of the revolution of the piston as possible. By the arrangement described by Mr. Dredge, the friction is certainly reduced; but the period during which the piston is in operation is greatly extended.

Mr. Dredge contends that "Davies's engine has no dead point, because there are *always* two pistons on the same shaft;" he should have said, not merely *two pistons*, but *two cylinders* likewise—so that the machine is not simply an engine, but a pair of engines. By *an engine*, is always understood an engine of a single cylinder, whether the engine be of the reciprocating or of the rotary class; and, according to this universal acceptation of the term, Davies's engine, so far from having no necessity for a fly-wheel—as having no dead point—requires a fly-wheel more (if it were possible) than a reciprocating engine; for in the latter, the fly is requisite to carry the crank through only about 15° on each side of the line of centres; but in Davies's engine, it has to continue the motion through one-third of the revolution, or 120° As I observed in my former letter, the fly-wheel is dispensed with, and the dead points are overcome in reciprocating engines by the same contrivance as is resorted to in Davies's engine; viz., by employing two engines acting at right angles to each other; but it is principally to obviate the necessity of employing either a fly-wheel or a second engine, that a rotary engine is a desideratum, and no engine can in strictness be considerer as a rotary engine which fails to effect this.

Mr. Dredge says that the extra expense consequent upon having two cylinders instead of one is very small, because the difference in the weight of metal employed is very small—thus taking no account of the chief item of the cost, the workmanship, which is nearly double in the case of the two cylinders.

In speaking of engines having one cylinder placed eccentrically within another, I did not instance them as having no reciprocating mòvement in any of their parts, but as having no dead points, and, further, no valves; and I afterwards pointed out other engines which had no reciprocating movements whatever.

I should not have touched uponthe space occupied by the engine hadnot Mr. Dredge put this forward as one of the advantages it possesses over reciprocating engines, and I still am of opinion that an oscillating engine might be put into as small a compass as an engine of the same power on Davies's construction.

In conclusion, I beg to say that I have no prejudice against rotary engines, but, on the contrary, am desirous that the practical difficulties which have hitherto opposed the introduction of them may be overcome, and I therefore regret that the one in question is not free from the defects I have pointed out. If the method employed by Mr. Davies for keeping the piston steam-tight, as it revolves over the surface of the cylinder, be not objectionable from want of elasticity, it becomes an important improvement, as obviating what has hitherto constituted the chief difficulty in rotary engines of whatever construction; but I am compelled to say that I think his engine is deficient in the essential points of a rotary engine.

I remain, Sir, yours, &c.,

A. Z.

March 10, 1849.

ON ALGEBRAIC SYMBOLS.

Sir,—I shall feel obliged by your publishing the following extracts,* which form the material portions of letters which I have recently received from an ingenious gentleman, and the publication of which will, I trust, have the effect of eliciting from Professor Young—what cannot fail to be interesting and instructive to all classes of readers—a disquisition on zero symbols.

Mr. Robert Harley to Mr. Cockle.

(Date, Blackburn, Nov. 11, 1848.)

. . . . . .

"I assure you it appears to me to be a startling assertion to say that $1 + \sqrt{x} = 0$ (*e. g.*) is an equation having *no* root, if the sign (+) before the

* Some oversights having occurred in the second letter, owing to Mr. R. Harley not having a copy of *Horæ. VIII.* before him, I have corrected the errors, marking my corrections by brackets [ ].

radical ($\surd$) be taken as indicated." . . "I cannot help stating that $(-1)^2$ appears to me to be the root in the preceding equation; for then

$$1 + \sqrt{x} = 1 + \sqrt{(-1)^2} = 1 + (-1) = 0.$$

Does not the fact of certain determined values of the "unknown," in a peculiar class of equations, not appearing to satisfy the given relation arise exclusively from a misinterpretation of the ambiguous sign ($\pm$) before the radical ($\surd$); and if we were to adopt some mode of distinguishing between $(-1)^2$ and $(+1)^2$ would not the difficulties that have occurred with regard to such equations as the preceding vanish? Not having thought very much about the subject, probably I am writing prematurely. I hope, however, you will pardon the freedom I take in expressing my *first* views of the question." . . .

(Date, Blackburn, Nov. 22, 1848.)

. . . .

"I am very much mistaken if Professor Young's fear, concerning the inconclusiveness of his proof of the impossibility of the relation $+0=-0$, so candidly and elegantly expressed in his paper on 'Congeneric Surd Equations,' in the [*Mechanics' Magazine* (vol. xlix., pp. 463—4)] is not [*sic*] without good foundation.

"In the first place, it appears to me that the same reason he assigns for the inadmissibility of the condition $+0=-0$, applies with equal force to the condition [$3\cdot0=2\cdot0$] and therefore, that if the root which substituted gives the former result must be rejected, the latter must be rejected for the same reason." . . . "If from both sides of the apparent equality [$3\cdot0=2\cdot0$], we take [$2\frac{1}{2}\cdot0$], we get $\frac{1}{2}\cdot0=-\frac{1}{2}\cdot0$, and this by the Professor's reasoning leads to the obvious absurdity [$\infty=0$].

"But I submit that the Professor's proof of the inequality of $+0$ and -0 is inaccurate. For that $3\cdot0=0$ cannot, I think, be questioned; and yet, if from both sides we subtract $2\cdot0$ we find the condition $+0=-0$, which must therefore be true. Besides, when we say $+0=-0$, by 0 we understand actually *zero*; whereas, when we say $\frac{1}{0}=\infty$, I conceive we employ 0 in a different sense from the above, that is, not as absolutely nothing (for in this case $\frac{1}{0}$ would have literally *no* value,) but as an indefinitely small quantity, or as a quantity less than any assignable number."

(Date, Blackburn, Dec. 4, 1848.)

"By your making whatever use you may think proper of the contents of any of my notes to you, as I have already signified, I shall feel honoured.

"Perhaps the following proof of the equality $+0=-0$, is not less clear and satisfactory than that I have already laid before you. In some respects, indeed, it seems preferable.

"First, obviously, $a-a=+0$ ...... (1)
changing signs, $-(a-a)=-0$;
$\therefore\ -a+a=-0$; or, $a-a=-0$ ...... (2).

Comparing (1) with (2) we find, as before $+0=-0$.

"The great candour evinced by Professor Young, in reference to this subject in the latter part of his paper, on 'Congeneric Surd Equations,' in Number 1318 of the [*Mechanics' Magazine*] is truly admirable, and, I am sure, well deserves the imitation of other mathematical writers." . . .

Although the distinction between the squares of positive and of negative unity has for some considerable time been recognized by analysts,* yet I have quoted the above passage respecting it because it shows the growing sense, among mathematicians, of the necessity for more nice discrimination than formerly of the symbols of algebra. At the same time I do not agree with the inference which is sought to be drawn, viz.—that $x=(-1)^2$ is a solution of the impossible equation above alluded to. The only effect of making $x=(-1)^2$ is to disguise the fact that the *negative* sign is given to the radical.

The argument in the second letter proceeds on the supposition (see vol. xlix., p. 367,) that the value $x=5$ conducts us to the equation $3\cdot0=2\cdot0$. The true result is, however, $3\sqrt{0}=2\cdot0$, *sup.* p. 106. I regret that I misled the writer, but I have extracted the argument, because there are possibly cases in which it may be applicable—at least that part of it which is contained in the first paragraph of the extract; and I would add, that it coincides with the line of argument which I had meditated when the receipt of Mr. Harley's letter relieved me from further consideration of the point, as I then thought.

At the same time I differ from the remaining portion of the extract from the second letter, except in so far as that I believe the equation $+0=-0$ to be true of *isolated* zero (*sup.* p. 104). I cannot admit either that $3\cdot0=0$, or that the reciprocal of isolated zero has no value; but I can see no objection whatever to the argument of the third letter.

On a reconsideration of the subject of the Example 8 of p. 130 of "Young's Algebra" (4th edition), I think the following is the explanation of the difficulty. The given equation may be put under the following form:

$$\sqrt{5-x}\left\{\sqrt{4+x}-2\sqrt{5-x}\right\}=0,$$

and when either factor vanishes the equation is satisfied.

At p. 344 of vol. xlviii. of this Journal, Professor Young has alluded to a letter addressed by him to me some time since. I have the letter still in my possession, and subjoin an extract from it:

Professor J. R. Young to Mr. Cockle.

(Date, Holywood, near Belfast, June 2, 1846.)

. . . . .

"I think you do not say too much when you predict that these 'views of the limiting cases will find many applications,' &c. If you look into Poisson's mode of obtaining integrals of trig. functions between 0 and ∞, or the transcript of some of them

* Peacock; *Third Report of British Association*, pp. 264 and 275.

in Gregory's Examples, you will at once see how erroneous all the results are. . . . .
The theory of *mean values* by which analysts so often obtain what they call a *unique* expression for indeterminate results, also falls to the ground. And it will, I think, be found that the Calculus of Variations and Virtual Velocities both admit of clearer exposition by the aid of these views."

It is but just for me to follow an example set by Prof. Young (vol. xlviii., p. 368) and to add that as the letter in question has remained unpublished, and entirely uncommunicated, the claims of "*da.*" in this matter are not in any way affected by the present publication of the above extract.

I am, Sir, yours, &c.,
JAMES COCKLE.

2, Church-yard Court, Temple,
February 3, 1848.

Postscript, Feb. 10th, 1849.—The perusal of a paper "On a System of Triple Algebra," &c., by the Rev. Professor C. Graves, in the current number of the *Philosophical Magazine* has suggested to me the following modular equation for tessarines:—

Let

$$m=w+x+y+z,$$

and

$$n=x+z,$$

and call m the *radix* and n the *subradix* of the tessarine t. Also let m', m'', be the radices, and n', n'' the subradices of two other tessarines, t' and t'' respectively. Then, if $t \times t'=t''$, we have

$$m''=mm'-2\,nn'.$$

And we have also the following relation,

$$n''=mn'+m'n-2\,nn'$$

whence we may readily obtain others.

J. C.

Correction.—Supra, p. 106, line 8, *for* $-$, *read* $+$.

Addendum to Mr. Cockle's Paper.—Second Postscript, February 24th, 1849. It is required to solve the equation

$$0=1+x+\sqrt{2}\,x\ldots\ldots(1.)$$

in terms of β.

This is an impossible equation (vol. xlix., p. 366, col. 1.) Put it under the form

$$0=1+\sqrt{\frac{2\,x}{(1+x)^2}},$$

and make

$$\frac{2\,x}{(1+x)^2}=\beta=\frac{1}{\beta},$$

where β has the same meaning as *supra*, p. 105, col. 1. Then we have

$$x^2+2\,(1-\beta)\,x+1=0;$$

whence, treating this as a quadratic in x^2, and making $\beta^2=1$, we have

$$x=\beta-1\pm\sqrt{1-2\,\beta}.$$

Now, if, in the expression

$$\frac{2\,x}{(1+x)^2},\ \ldots\ldots(A),$$

we substitute for x its value, the result is

$$\frac{2\left\{\,\beta-1\pm\sqrt{1-2\,\beta}\,\right\}}{2\left\{\,1-\beta\pm\beta\sqrt{1-2\,\beta}\right\}}$$

But the denominator of this fraction may be put under the form

$$2\,\beta\left\{\,\beta-1\pm\sqrt{1-2\,\beta}\,\right\}$$

hence it is easy to see that the expression (A) becomes $\frac{1}{\beta}$ or β. This verifies the solution.

ON THE APPLICATION OF THE PANOPTICON, OR CENTRAL INSPECTION PRINCIPLE OF CONSTRUCTION TO MANUFACTORIES, ACADEMIES, AND SCHOOLS.

When so much thought as has been bestowed of late on the construction of buildings for manufacturing purposes, it seems remarkable that the Panopticon, or Central Inspection Principle, has been disregarded; yet the advantages afforded by it are many, and of a nature to be appreciated by manufacturers.

The importance of obtaining a central point of observation from which to inspect at once all the operations carried on in a building, and of all the subordinates employed in it, occurred first in the year 1787 to the late Sir Samuel, then Lieut.-Col. Bentham. He was at that time with his battalion at Zadobras, near Cricheft, in White Russia, where he applied the principle in a building destined by Prince Potemkin for an immense manufactory on his estates in that country. Many of the purposes to which a Panopticon building is applicable were detailed at the time by Sir Samuel's brother, Jeremy Bentham,* as also the advantages it is capable of affording, so that the present observations relative to it will be confined to its application as a manufactory and as a school.

* Jeremy Bentham's account of the Panopticon, or Inspection House, appears in the second volume of his works.

According to customary modes of structure, the superintendent of a manufactory has to travel from building to building, and from floor to floor of each one, before he can ascertain that his foremen, overlookers, and working hands are properly employed, and active in their respective duties; he can be present but in one part of his establishment at any one time, so that his subordinates but too frequently profit by his absence to indulge in diminished energy. But in a Panopticon, the superintendent has never to undergo fatigue, or incur loss of time in going from place to place; for from his central station, he can witness all transactions in all of his different workshops; and his subordinates, to whom those in the inspection room are invisible, must necessarily work under the impression that the eye of the master is constantly upon them.

Much architectural skill, and many mathematical calculations, are required to obtain this power of central inspection where there are several stories in a building; and in the year 1793, considerable labour was bestowed by Sir Samuel in bringing to perfection the design for a Panopticon. It was intended, and sanctioned by Government for the reception and industrial employment of 1000 prisoners, and was the first building, it is believed, that was contrived to be entirely fire-proof; but although much of the iron-work was cast, the vacillations of Government finally prevented its erection. The plans were, however, not altogether lost; for in the year 1807, a Panopticon was, by command of the Emperor Alexander, erected according to these plans, so far as regards general arrangement, at Ochta, near St. Petersburgh, for the scientific education of youth as officers in the army and navy, and for the industrial rearment of young recruits for the navy. The greater part of these young people were to be employed in manufactories, more particularly of the several articles required for the service of the army and navy; as, for instance, amongst the smaller objects, compasses, and various mathematical, physical, and optical instruments, clothing for the army and navy, as stockings, shoes, boots, tailors' work, &c., and of more bulky articles, wood-work in general, sail-cloth weaving, and other items of the first necessity for the naval service.

A short description of that Panopticon, together with the accompanying plans and sections found amongst drawings made in 1793, would greatly facilitate the formation of designs on that principle at the present day. The description that follows of the Panopticon at Ochta, was drawn up at the time of its erection; but the paper is not complete, as the part of it describing the wings, and several details of construction, has not been found.

Orders were conveyed from the inspection room to the farthest ends of the wings, and to intermediate parts, by means of speaking tubes.

Description of the Panopticon at Ochta.

The building consists of a dodecagonal part, 140 feet in diameter, and of five radial buildings, each of them 105 feet long, 30 feet broad.

At the centre of the building, a circle of 3 feet 4 inches in diameter, is appropriated as a chamber from the top to the bottom of the building, through which the inspector, in his chair, passes to view the highest and the lowest floors of the structure.

Around this chamber are annular apartments forming a ring, six stories in height, basement and attic stories included. The outer diameter of this ring is 28 feet. The basement of this part is appropriated to heating stoves, conveyance of water, &c.; the next floor above, as a clerks' office. Above this office is the principal inspection room; over the inspection room, the upper floors are appropriated to uses which, at the same time, allow of occasional inspection from them.

Surrounding these annular apartments is a ring 10 feet in diameter, in this are constructed staircases and connecting galleries up to within two stories of the top. The two upper stories are appropriated as infirmaries, and therefore not communicating with the interior of the building.

Without this space is another ring of building divided into twelve radial parts, in which are three floors extending from the interior to the exterior part of this ring; also one half floor between each

Fig. 1.

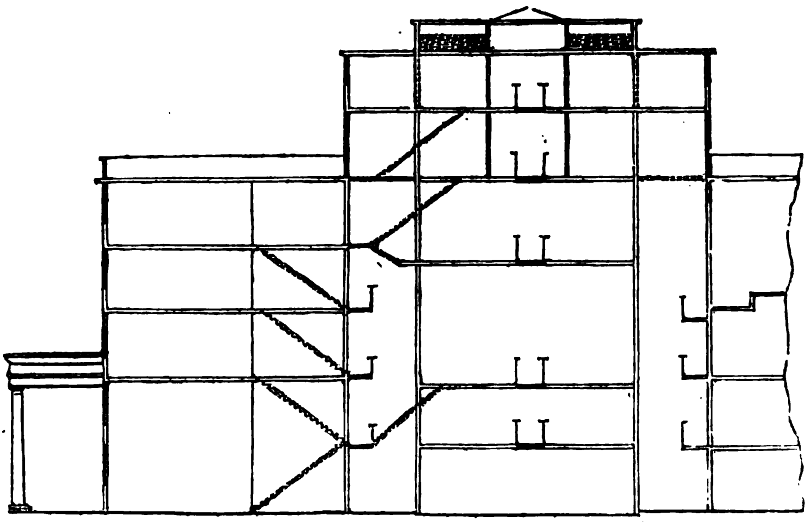
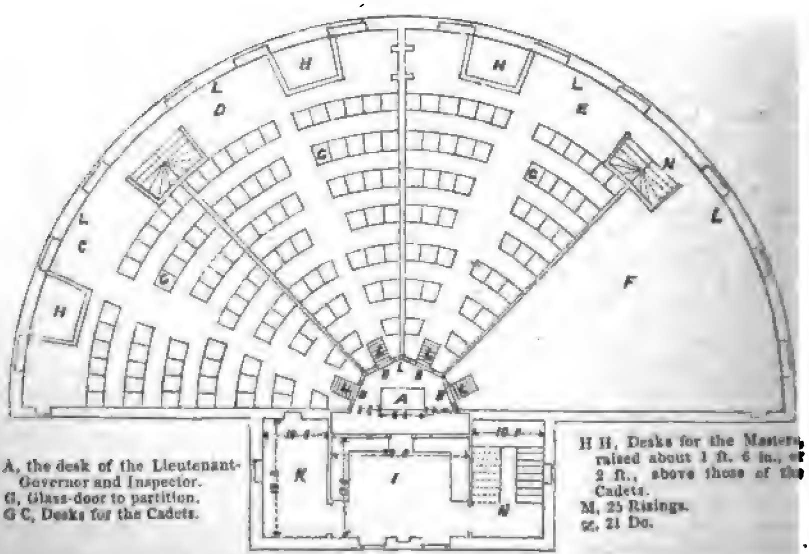


Fig. 3.



A, the desk of the Lieutenant-Governor and Inspector.
G, Glass-door to partition.
G C, Desks for the Cadets.

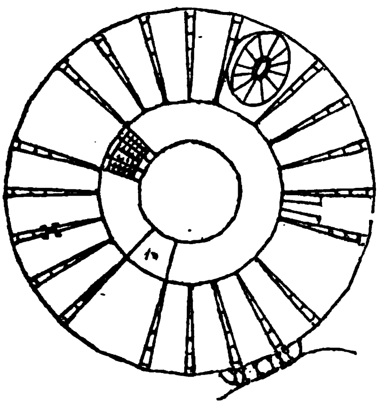
H H, Desks for the Masters, raised about 1 ft. 6 in., or 2 ft., above those of the Cadets.
M, 25 Risings.
N, 21 Do.

floor, that half floor at the outer side of the ring.* Each radial part is 42 feet from the inside to the outside of the ring.

These radial apartments terminate the dodecagonal part of the building, the total diameter of which is 140 feet.

The five buildings, wings, or rays, are connected with five of the sides of the dodecagonal part, leaving a side of it between each wing; the sixth part is appropriated as a general entrance to the establishment.

Fig. 2.



His imperial majesty had caused his ministers to request from the British Government a leave of absence for Sir Samuel sufficient for him to set this establishment fairly at work; but on the breaking out of war between the two countries, he returned home, in September, 1807. The building was, however, at that time already so far advanced, that he witnessed before his departure from St. Petersburgh the perfect inspection obtained over the whole structure from the inspection room. This was effected by a very nice adjustment of the relative height of floors—one of the two principal floors being *below*, the other *above* the floor of the inspection room. The upper and the basement floors were inspected from a central chair, suspended by a counterpoise, and regulated in its movements up and down by a simple and safe apparatus, easily managed by the inspector himself.

It had been considered impossible to heat and ventilate at the same time a building so immense, and of such a form; but Sir Samuel had witnessed at the manufactory of the Messrs. Strutt, at Belper, the efficacy of a stove invented by one of those gentlemen, and by their favour obtained a model of it. A stove on that principle, erected the year following in one of the wings of the Panopticon, had far exceeded, as he learnt, the expectations formed of it; for with an average cold of above 27 degrees below the freezing point of Fahrenheit, the whole of one of those immense wings was kept, day and night, heated, for 96 hours, to 60 degrees of Fahrenheit, that is, a difference of heat from the external air of 55 degrees, by the consumption of no more than "one cubic fathom of very indifferent fire-wood." The heat was conveyed from end to end, and from story to story, by heated air passing through trunks, and regulated by means of valves in them, so that perfect ventilation, as well as warmth, was ensured throughout. The greatest difference in the degree of heat at the stove and at the distance from it of 100 feet, was 4½ degrees of Fahrenheit.

Unfortunately, this Panopticon was in a few years consumed by fire. It had been built of wood, for expedition sake, in order that Sir Samuel might be enabled to institute, before his return to England, the general management of the establishment. After his departure, some pillars intended to be made of cast iron, were made of wood, and probably contributed to the destruction of the fabric. But pupils reared in it were, during the war, found so useful, that the best of these youth were taken for service elsewhere by fifty at a time, even so early as 1808.

Figs. 1 and 2 are copied from sketches found among General Bentham's papers. They are conjectured to be—the one an elevation (in part), and the other a plan of the Ochta Panopticon, but on different scales.

The application of the Panopticon principle to a school, was in contemplation as early as the year 1796, when it was

* These radial floors were destined for tailors for army and navy clothing, shoe and boot-makers, and other analogous trades; the wings, for workers in wood and metals.

intended to erect a new school for the gentlemen cadets at Woolwich. On that occasion, the late General, then Colonel Twiss—struck with the power given by that principle, of overlooking by a head master, at once the pupils and the several masters under his control—requested his friend, Sir Samuel, to devise a plan for the intended school. A half circle, or a half duodecagon, was in this instance deemed the most convenient form, and that one floor of the building would suffice for the accommodation of all the young gentlemen whilst at their sedentary studies, and exercises of fencing and dancing. The architect, Mr. Bunce, who had, in 1793, been employed to make drawings of the then intended Panopticon prison, had now instructions given him, such as would enable him to make out a design which should satisfy the requirements furnished by General Twiss.

The design made in consequence, provided a study for the Lieutenant-Governor and the inspector, where, from their desks, they could overlook all the masters, and all of the cadets, in every academy; the partition between the study and the academies being of glass.

The semicircular area half surrounding the Lieutenant-Governor's and inspectors' study, was divided into four radial parts, one part for each of the three academies; in each academy was a desk for the master, from which he overlooked the cadets of his class, fifty in number. For each cadet there was provided a desk and seat placed in an inclosed stall. These stalls constituted a prominent feature of the arrangement; they were so contrived as that the occupants, whilst at their studies, could neither see, nor be seen by any other of the cadets; whilst they were all of them under the inspection of the master of the class. A similar arrangement has since been adopted in the Pentonville Penitentiary, where the seats for the prisoners when present at Divine service, are constructed precisely in the same manner as they were designed for the intended Panopticon chapel, 1793.*

The fourth ray or division equally under inspection, was designed as the academy for fencing and dancing.

Partitions between the academies were so designed as to prevent the transmission of sound from one to the other; they were supported on pillars, so that the whole of the ground-floor might be as one large museum for models, &c.

It can hardly be hoped that funds would be afforded for providing such screens in schools for the lower orders of children—yet every person conversant with such establishments must be aware how greatly application to study in them is impeded by the mischievous tricks and temptations of idle and vicious boys—but in schools of a higher description, such an arrangement may possibly come to be introduced at some future time.

That design for the academy at Woolwich was not carried into execution; there arose an apprehension that the cadets would not submit to real inspection—military as was to be their education, and subject as they might expect to be through life to military authority and discipline.

Some minor objections to the stalls were suggested by General Twiss, which were parried in a familiar letter to him from Sir Samuel. His observations on the subject are such as merit attention, where affording facilities in education may be thought desirable. The letter was as follows:

"Dear Sir,—I was very sorry to leave town without seeing you again, and I understand that you have made some progress with your school plan, and that you had talked with Mr. Bunce about it: but I was very sorry to learn that you seemed to object to the screens between the boys. I am not at all surprised, however, of your fear of the boys cutting holes in the screens—you, perhaps, as well as I, have been often guilty of such tricks when young. According to our plan, however, you must bear in mind that the boys are never to be in the seats thus screened but during the presence of the master, and to whom any motion of the hand, as well as of the head, would be visible. Under such circumstances, then, the discipline must be extremely negligent if

* This arrangement of the chapel at Pentonville affords a striking example of the fact, that when two men of ability have it in view to produce the same effect, they frequently invent identical means of obtaining their purpose. The seats and screens for the prisoners at Pentonville are similar to those invented by Sir Samuel; of which a drawing, made in the year 1793, still exists, the only difference being that in the latter a little more room for kneeling is allowed than in those at Pentonville; yet there is no reason to suppose that Colonel Jebb ever saw those drawings. Fig. 3 is a reduced copy of this drawing.

any screen-cutting tricks could evér commence—no such idea could be formed under such an impression of the certainty of detection.

"I must beg you next to consider that when you and I used to cut our tables and benches, it was in company with other boys, who not only encouraged us by their presence, or perhaps by their example, but who were necessarily implicated with us in the blame; it never, therefore, could be ascertained which of us it was that did the mischief, and consequently we had no apprehension of punishment or detection. Here, again, the difference of circumstances is such, as to make a total change in the consequences. Each boy occupying constantly the same seat, without any opportunity, or possibility even, of admitting a companion in it; no doubt, then, on whom to lay the blame—no fear of injustice in the punishment. Each boy could be no otherwise than perfectly responsible for what happened in the interior of his *stall*, and I can conceive no discipline so lax as not to ensure good order under such circumstances.

"When you consider this expedient of perfect seclusion from all distraction, you will be satisfied, I am sure, that it is the ground-work of all good order, and of the most striking twofold importance, contributing at the same time in the highest degree to the facility of receiving instruction on the part of the scholar, and to the facility of transmitting it on the part of the master.—A single wink or gesture from the idle boy to the assiduous is sufficient to divert the attention, and to disturb altogether the faculties during the whole lesson, to a degree that, perhaps, no endeavours of the master can correct.

"The worst disposed boy, as well as the best, knowing that the task must be done, cannot but wish to have the power of doing it; that wish is rendered abortive only by the stronger influence of the ideas of the moment, which of himself he has not the power to counteract, when the cause of distraction proceeds from other boys. Means of getting the better of untoward propensities is the greatest favour you can confer on a boy; and it seems cruel to enforce diligence, without previously doing all that can be done to remove temptation to idleness.

"Faithfully, yours, my dear Sir,
"SAMUEL BENTHAM."

Screens of this description having been first employed at the Penitentiary, this circumstance may, unfortunately, prove a further impediment to their introduction in a school, since they might be branded with the name of prisons; yet at Harrow, years ago, it was considered as a valuable privilege by some boarders with the head master, that they had each of them a little separate inclosure in which they could study without distraction.

A Panopticon of a circular, or duodecagonal form, seems particularly suitable for such an establishment as the projected farm schools of the Philanthropic Society. A single ray of the duodecagon, if of 120 or 130 feet in diameter, would afford accommodation for each intended family of boys—the basement, as kitchen, laundry, baths, &c.; the ground-floor, as dining hall; above it workshop and school-room; in the attic, dormitories. The central part would afford an inspection hall for the chief superintendent of the whole establishment, and offices for general management; above it a room, where the boys of all the several families might assemble to hear lectures. In this centre, also, would be the chapel.

Each alternate decagonal ray might in the lower stories afford store-rooms, tool-houses, &c.; whilst the upper floors might be appropriated as lodging for the family of the father (as he might be termed) of each division of pupils.

Supposing such a Panopticon to be placed in the centre of the estate, the portion of land to be cultivated by each family would be divided off radially, in continuation of the divisions of the building.

In an establishment of the nature of that proposed by the Philanthropic Society, it could not but be considered as desirable that the public should, under certain regulations, be admitted to witness the economy and good order of the whole. An inspection room affords ample opportunity for frequent observation of this wholesome nature; and that without disturbing in any way either the pupils or their master.

Even all operations in the field might at all times be witnessed from the centre, supposing a central portion of the roof to be appropriated as an observatory, whether for the general superintendent himself, or for the occasional public visitor.

Sir,—Every one who has assisted in the working of a fire engine, must have observed how much impulsive force is wasted at the end of each stroke. The reciprocating beam generally descends with increased velocity, and is suddenly brought up with a great jerk, only slightly moderated by the strong spring usually placed to receive the violence of the shock. It occurred to me lately that a more continuous application of manual power could be effected by using the four wheels of the engine as fly-wheels, and by driving them by means of cranks on the axles.

Additional half cranks could be attached to the outer extremities of the axletrees, when the engine has been brought into position; and thus the same number of men as at present be enabled to lend their strength. I shall return to this subject more in detail, unless I find that there are objections to the plan here proposed which I have overlooked or am unable to obviate.

At page 137 of the present volume, I observe a suggestion respecting railway train signals, by Mr. Dommett. Without having seen the letter he alludes to in the newspapers, and before the publication of his communication to you, an idea occurred to me something similar in principle, but with sufficient difference to justify my introducing it to your notice. My object is to enable the engine driver to discover, *without turning his face round*, signals from any part of the train behind him.

Fig. 2.

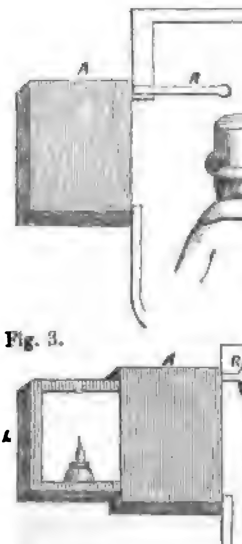
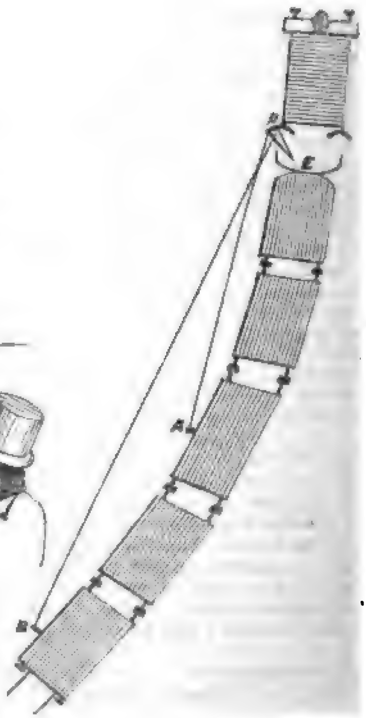


Fig. 3.

Fig. 1.



The sketch, fig. 1, represents a bird's-eye view of a railway train, supposed to be travelling round a sharp curve—that being the most *trying* position for the working of my plan for signals. On each side of the engine, and in advance of the engine driver, E, is a curved mirror, as at R. In case of an accident occurring in any carriage of the train, or when sufficient cause makes a stoppage

of the train necessary, a lamp having a red light, is exhibited from the particular carriage, as at A or B, and being reflected to E from the mirror, calls the attention of the driver to the danger.

The construction of this lamp, and the mode of using it, will be seen in figs. 2 and 3. The lamp is fixed above the side window of the carriage, and serves to light that compartment to which it is attached. If it were placed between two compartments, it would light both, and be available as a signal to either. The outer case, A, is fixed to the carriage, and painted black. By pressing the rod, R, the lamp is protruded beyond the case, and, being glazed in front and behind with red glass, it will attract the attention of both guard and engine-driver. In order to prevent the lamp from illuminating the carriage in general with a red light, two reflecting plates may be attached to the fixed case, sliding in slots cut in the framework of that side of the lamp next the carriage, so that when the lamp occupies its ordinary position, the red glass will be covered, and the light reflected from the polished metallic surfaces. In Mr. Dommett's plan for using lamps, this will be immediately remarked to be an objection, that the several lamps along a train of twenty carriages would cover each other, and obstruct the view of the guard, unless he were placed considerably above the level of the train.

It was the necessity of providing against this which compelled me to suggest that the lamp should be moved (when called into requisition) beyond the line occupied by those lamps not in action.

A day signal might be added by affixing a square of tin, painted red, to the top of the lamp, which, when not employed, would remain concealed between two flat black plates; but I am doubtful how far the principle of the mirror on the engine would apply to this part of the apparatus. The whole of this construction naturally occurred to my mind in conjunction with a proposition I entertained four or five years ago, and which I may mention here, as it is, perhaps, new to some of your readers. This consisted in fixing a mirror in a boat in such a position that a person sculling or rowing might observe, at each forward bend of his body, the situation of objects behind him, and thus be enabled to steer without turning round his head.

I am, Sir, yours, &c.,

JOHN M'GREGOR.

24, Lincoln's-Inn-Fields,
March 26, 1849.

HARVEY'S APPARATUS FOR CLEANSING POTTERS' MATERIALS FROM PARTICLES OF IRON.

[Registered under the Act for the Protection of Articles of Utility. William Kenwright Harvey, of Blurton, Staffordshire, Proprietor.]

Fig. 1 is a plan of this useful apparatus, and fig. 2, a section on the line AB of fig. 1. A is a hollow case; B, a partition, into which there are fitted a number of magnetic bars, CCC. The lengths of these bars are nearly equal to the width of the case A. They are arranged in the partition B, in zig zag lines from the bottom upwards, as separately represented in fig. 3, which is a front elevation of the partition.

Fig. 1.

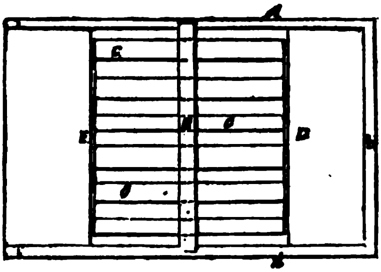


Fig. 2.

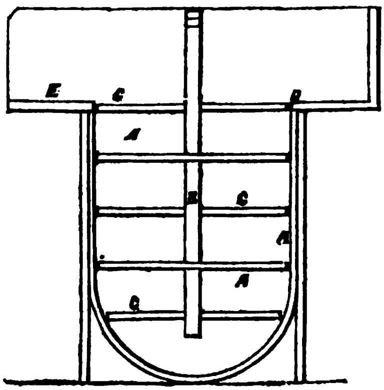
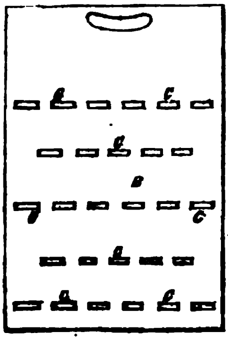
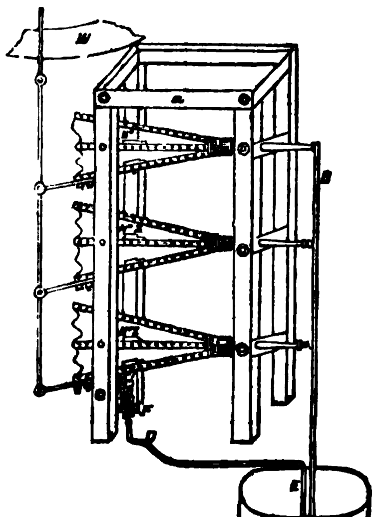


Fig. 3.



The same fluid materials are poured into the trough at D, and descend on the one side of the partition, and rise up on the other, as in an inverted syphon. The particles of iron, if any, are sure to come into close proximity to some one or other of the magnetic bars, when they will be retained by the magnetic attraction. The cleansed materials escape by the spout.

APPARATUS FOR VENTILATING MINES.



Sir,—The lamentable colliery explosion at Darley Main, near Barnsley, causing the loss of 75 lives, has suggested a plan to my mind, whereby similar casualties may be prevented, if properly attended to. It consists in the employment (in such a mine as the Darley Main) of a blowing apparatus of the description represented in the prefixed sketch. *a*, is a framework of wood or iron, which supports three pairs of large bellows, Nos. 1, 2, 3, which are worked by a connecting-rod from the fly-wheel W of the pit engine. Nos. 1 and 2 are connected to one pipe, B, which leads to the pitshaft—descends close to the side of the same—and then passes horizontally along the top of the waygate, whence branches lead off to the different workings where the men are employed. To the underside of the pair of bellows, No. 3, there is attached immediately over the clack or feed-valve a leathern hose, C, 9 or 10 inches in diameter, and 20 in length; and to this a diminishing brass screw joint, F, to which is connected a smaller leathern or gutta percha hose, D, which goes to the top of the shaft, and is there joined to a zinc tube, E, which descends the shaft alongside the tube from the bellows, Nos. 1 and 2. My reason for letting these bellows take their feed out of the workings is, because the gas accumulates towards the top of the roof, and it will be drawn up by them, and delivered out at the bellows pipe, No. 3; consequently, there will always be a regular current of air kept up. Two pairs of bellows are constantly forcing air into the workings, and one pair drawing out the inflammable gas. It will be perceived that there will be twice as much air forced into the workings by the former as abstracted by the latter. It must be understood that I do not intend to do away with the "fire pan" or furnace, which is used in the mine. The confined air is intended to drive the inflammable gas from the workings in the waygate, and prevent it from accumulating in the workings. And, as all pits which are ventilated with furnaces alone, have a tendency to work indifferently under certain states of the atmosphere, this I consider is the only way to remedy the evil; and I am of opinion that carrying a surplus of confined air to the workings, will keep up a constant stream to assist the furnaces.

Should it be found advisable to use all the bellows to force air into the workings,

and increase the current in the waygate, that can be effected by unscrewing the hose, C, from the diminishing joint, F, and fixing it to the pipe of bellows No. 3.

I also wish it to be understood, that every morning previous to the men commencing work, the bellows should be in motion long enough to clear the workings of any inflammable gas. Where there is a lift engine for pumping water from the mine, the bellows may be kept in constant operation, and where this is not the case, the bellows would be in action every time the coals are drawn up during the day.

I am, Sir, yours, &c.,
JOHN WARBURTON.
Machinist.

New York Mills, Harrogate.

MR. APPOLD'S IMPROVEMENTS IN ELECTRIC CLOCKS.

Sir,—I am much interested in the account given by Mr. Holmes of the improvements in electric clocks effected by Mr. Appold, as briefly alluded to in No. 1334 of your Magazine. I am sure that many of your readers will concur with me in considering these improvements worthy of being related more in detail, especially that by which the pendulum of the clock receives impulses from the magnet only when they are needed.

I am, Sir, yours, &c.,
JOHN M'GREGOR.

TATE'S DIFFERENTIAL AND INTEGRAL CALCULUS.*

The first twenty pages of this Treatise are taken up with introductory algebraical theorems, the Binomial Theorem, Indeterminate Coefficients, &c., and Elementary Notions of the Application of Algebra to Geometry. For those whose reading in algebra has been confined to the mere elementary portion, such an introduction is, no doubt, useful; but we doubt whether *such* readers will find Mr. Tate's treatment of the Binomial Theorem and Indeterminate Coefficients suited to their wants. Those who are familiar with the subject do not require such an introduction, and those who approach these things for the first time, will certainly not be able to comprehend "Euler's proof" of the binomial, which is here given, or be satisfied (if they are at all scrupulous about having *proofs* for everything asserted) with that venerable recipe for getting through the difficulty of the principle of "Indeterminate Coefficients," which consists in making away clandestinely with the unfortunate variable (x): a method of disposing of obstacles in the way to an object, which savours more of novel writers and hard-up dramatists than of honest mathematicians. Mr. Tate then proceeds to the introductory part of the differential calculus itself; and the next twenty pages, which are devoted to the illustration of "Limiting Values," is, in our opinion, likely to be the most useful portion of the book. A chapter like this was very much needed in nearly all former treatises; and, by entering fully into elementary illustration and examples, Mr. Tate has rendered a very great service to beginners. It is strange, that of so many writers on this subject, so few should have taken the trouble to work out a number of simple examples in the manner here done; for, without abundance of such elementary illustration (at the risk of what may appear to more advanced students as useless repetition), the beginner is sure to be baffled and discouraged.

The rules for differentiation are investigated neatly and clearly: and the subject of "Maxima and Minima" is tolerably well done. But when we come to Taylor's Theorem (page 102, &c.), it becomes evident that Mr. Tate has not profited much by the researches of Cauchy and others in this important part of the subject. Any of the works of Moigno, De Morgan, or Price, to which Mr. Tate has alluded in his preface, would, if he had actually consulted them, have put him in possession of much more satisfactory views than those with which he has contented himself and *dis*-contented his readers. The whole theory of algebraic development and series is so intimately connected with the researches and improved methods just alluded to, that, by not adopt-

* The Principles of the Differential and Integral Calculus Simplified, and applied to the Solution of various Useful Problems in Practical Mathematics and Mechanics. By Thomas Tate, &c. Longman and Co.

ing them, Mr. Tate has deprived both himself and his readers of much valuable assistance and aids towards "simplification."

A very large, and we think a disproportionate share of the book is taken up with the mere details and mechanical processes of integration. Indeed, there is scarcely anything else in this part of the book, but such purely mechanical processes, except the examples of the application to finding areas, &c. There is very little said to explain the real nature of such applications, and to give the learner clear and satisfactory views of the connection between the algebraical formula of an integral and the *summation* which it represents in a geometrical or physical problem.

The application to mechanics occupies the last twenty pages of the work. The paragraphs headed "acceleration of motion by given moving forces," are anything but clearly worded. We feel quite certain that no one who is not already familiar with the subject will acquire clear conceptions of what is meant by "Moving Force," &c., from Mr. Tate's description. It is a difficult subject to explain clearly we admit, and Mr. Tate's is only the most recent failure. But we must remember the professed object of the work—simplification; *i. e.*, to do what others have failed to do. It appears also to us, that Mr. Tate has neither allowed himself sufficient space for this (and some other) parts of the subject, nor sufficient time. A great proportion of the pages occupied with mere algebraic formulæ of integration, might have been much better employed: and in several places there are marks of too hasty composition. This applies particularly to the concluding portion of the work: the subject of the strength of materials, to which the last three pages are given, is much more clearly treated in Moseley's large work, which makes no pretensions to "simplification," and also in Appendix to Weisbach.

We have thus pointed out what we consider to be serious defects in the work: they are defects, however, which Mr. Tate may easily remedy in another edition. Upon the whole, we can cordially recommend it to those who are about to commence the subject. The fulness of the introductory part, and the numerous examples are the redeeming features, and will render it well worth purchasing by a very large class of learners.

We may take this opportunity of recommending to the more advanced student a recent work, on the same subject, by the Rev. B. Price, of Oxford. In this work the theory of development of functions is treated according to the improved methods we have above alluded to, and it will supply the student with information on those points in which Mr. Tate's work is chiefly defective—points, too, of very great importance, involving, in fact, the whole theory and nature of algebraic development—expansion in series, or whatever name be given to it.

Mr. Tate has dedicated his work to the Rev. H. Moseley, in the following terms:—

"Reverend and Dear Sir.—This work I inscribe to you, as a tribute of esteem on account of *the discoveries with which you have enriched physical science;* and as an acknowledgment of the value which I attach to your services in promoting elementary education. That you may long continue to be a distinguished instrument, under the blessing of Divine Providence, in elevating the intellectual and moral condition of the people of this country, is the earnest wish of,

"Your humble and obliged servant,

"THOMAS TATE."

Now, what those "discoveries" are, with which Mr. Moseley "has enriched physical science," we are utterly at a loss to imagine. That he has written many useful and excellent works we, and most of our readers, are well aware. But where in any of these works "is there anything which by any stretch of the imagination can be considered a "discovery in physical science?" With the exception of a theoretical "principle of Least Resistance," to which Mr. Moseley lays claim, and the truth of which—or, at any rate, the *proof* of which—has been disputed (a controversy between Professor Moseley and Mr. Earnshaw on this subject was carried on for some time in the *Philosophical Magazine*), we are not aware of anything whatever original in his produc-

tions. That they are, many of them, excellent elementary books is sufficient ground of praise without resorting to panegyric unwarranted by fact. We are very reluctant to make these remarks, but we cannot allow the dignity of science to be debased, and the honour of scientific discovery to be prostituted in this way. Mr. Tate is in the habit of dedicating all his books to some influential person or other; and so we suppose we shall next have a dedication to Mr. Kay Shuttleworth, setting forth his "splendid discoveries in the Theory and Practice of Education." It is bad enough when the mercenary mob who taint our various "Societies" presume to talk about scientific honours as men having authority to decide thereon; infinitely worse is it when one real cultivator of science, like Mr. Tate, degrades it by ascribing honours to persons who have no title to them.

ROBINSON AND SIM'S SMOKE RESPIRATOR.

A series of experiments were made last Monday, at the residence of Mr. John Robt. Taylor, Red Lion-square, in presence of a committee of the Royal Society for the Protection of Life from Fire, for the purpose of testing the merits of a new smoke respirator, invented by two of the society's men, Robinson and Siems. It consists of a helmet with sight-holes in it, similar to a diver's helmet, to which a respirator is attached, which is drawn close over the mouth and nostrils. The respirator is so constructed (by means which are for the present kept secret) that the fireman is enabled to breathe freely in the midst of the most dense smoke, and, consequently, to retain perfect command over all his faculties.

The first experiment was made with damped shavings and saw-dust, in a small room, 19 feet long, 10 feet high, and 5 feet broad. A dense body of smoke, charged with vapour, was produced, in which the two members, both provided with respirators, remained for upwards of half an hour, without appearing to experience the slightest inconvenience.

A second trial was made with dry wood, partially coated with some resinous preparation. When the temperature of the room was raised sufficiently high, the firemen entered, and remained there for more than ten minutes, and would have remained longer, if required, with the same success as in the first experiment.

A gentleman present, who was desirous of testing the effects of this dry and heated atmosphere without a respirator, ventured into the room, but came out after a minute or two, pronouncing it to be insupportable.

In reply to a proposition that the inventors should test the efficiency of the respirator in a room, the atmosphere of which was so vitiated by combustion that no light could live in it, Robinson stated that he did not pretend to be able to live in the midst of fire, like a salamander, or to create oxygen —but simply to purify the atmosphere of a chamber in an ordinary case of fire, so as to render it fit for respiration.

Altogether, the result of the experiments appeared to give great satisfaction to the committee, and weie, certainly, as far as we could judge, eminently successful.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING FRIDAY, MARCH 30.

JOSEPH GILLOTT and JOHN MORRISON, Birmingham. *For improvements in ornamenting cylindrical and other surfaces of wood or other material.* Patent dated September 28, 1848.

The patentees remark that the ornaments upon the cylindrical surfaces of penholders, pencil cases, &c., have hitherto been produced by causing them to pass through fixed dies or plates, which have the effect of compressing or embossing them, and that the lines of these ornaments are always parallel to the axis of the article; while their invention has for its object, to produce these lines in a helical, or partially in a helical direction, by causing the die or plate to rotate wholly or partially, and the article to be held fast or to rotate, as may best answer. The machine by which this is effected consists of a bed plate with dove-tailed grooves, in which a top plate, carrying the forcer, is made to slide by a toothed wheel gearing into a rack riveted to the back. A collar, which contains the straight grooved die, is fixed to one end of the bed plate, opposite to the forcer, and has a sliding bar, supported in suitable bearings, attached to the top part by a short connecting rod. One end of the sliding bar is connected to a lever, the other end of which is acted upon by the indentations of a tin plate, which is screwed to one side of the top plate; so that as it travels a partial rotary motion will be imparted to the die, while the article will be held fast by the roughened end of the forcer.

Or, the grooves of the die may be cut obliquely, and the end of the forcer hollowed out to allow the article to turn therein.

Claims.—Embossing cylindrical or other

forms of wood, or other materials, by passing them between dies or plates, with oblique or straight grooves, which are made to rotate, or partially to rotate, and causing the ornamented article to be held fast, or to rotate on its axis, so as to produce the ornamenting lines in helical or partially in oblique directions.

ROBERT STIRLING NEWALL, of Gateshead, Durham. *For improvements in locks, in springs, and in the means of fastening and setting up the rigging of ships.* Patent dated September 28, 1848.

We shall give this specification at length in our next, and content ourselves for the present with stating the heads of Mr. Newall's invention.

First. He "claims a safety lock of a new construction, in the general arrangement and combination of parts" of which the same consists. It is decidedly original and likely to answer well.

Second. A spring composed of a peculiar combination of iron plates and vulcanised caoutchouc; particularly applicable to ships' rigging.

And, *third*, a new mode of fastening and setting up the rigging of ships.

FENNELL ALLMAN, Charles-street, St. James's-square, Westminster, consulting engineer. *For certain improvements in apparatus for the production of light from electricity.* Patent dated 28th Sept., 1848.

These improvements refer to the arrangement of the electrodes, points, or luminous terminals employed in the production of electric light, and also to the battery.

The patentee, after briefly noticing the characteristic features of the different inventions relating to this subject, states, that the chief difficulty in the production of a good electric light consists in the fulfilment of the three following conditions:

1. The electrodes between which the light is to be produced should be kept in contact prior to the passage of the electric current, and when it ceases.

2. The electrodes should be separated a certain distance, which depends upon the quantity and intensity of the electric current, and the resistance to its passage.

3. The electrodes or their terminal surfaces should be maintained at this limited distance apart, subject to variations of the current, and the destruction of the electrodes by consumption, dissipation, or other causes.

And all of these conditions will, according to the patentee, be fulfilled by employing any of the following arrangements:

Permanent Magnet and Conducter.

A permanent magnet is constructed in the ordinary manner, and supported by a central axis, on which it is free to oscillate, and parallel to and underneath the space between two coils of insulated copper wire. The electrodes, which may be of carbon, or other suitable material, are supported in holders inside a hemispherical lamp. The top electrode is connected by a link to one end of the permanent magnet, and by a thin strip of silver foil to the copper coil of wire, while the bottom one is connected to the battery. A weight is suspended to a curved bar which is attached, at the other end, to the central part of the permanent magnet, and has the effect of inclining downwards, that end of the magnet which is attached to the upper electrode holder, and thereby to keep the bottom of the top electrode in contact with the top of the lower electrode. The action of this weight is regulated by a counterbalance weight, suspended to the other end of the permanent magnet. When a light is required to be produced, the lower electrode is pushed up into contact with the top one, and a current of electricity caused to pass along the coil of copper wire, down the strip of silver foil, through the top holder, and electrode, the bottom electrode and its holder, and, lastly, along a conducter back to the battery. At the same time the permanent magnet will be deflected by the action of the passage of the electric current, in the reverse direction of that to which it is inclined by the central weight; and, consequently, the top electrode lifted up from the lower electrode, and maintained at a distance therefrom, and for a period dependent upon the intensity and continuity of the electric current. It will be evident that the electrodes can never be so far separated as to break the circuit of the electric current, since that would be cause destroying effect, and that the distance between them will decrease only (by the action of the weight) with the decrease in the intensity of the electric current; and that the two first conditions being thus fulfilled, the third is a necessary consequence.

It will thus be seen that Mr. Allman breaks the contact of the two electrodes, maintains them at the proper distance for producing the light, and regulates it according to the quantity and intensity of the electric current, by means of the action of an artificial magnet upon a permanent magnet, the power of the first being produced by the electric current, which also produces the light.

Permanent and Induced Magnets Combined.

The permanent magnet is swivelled in a central axle, and connected to the holder of the top electrode, as in the preceding case. An induced magnet is fixed above the free

end of the permanent magnet, and a second induced magnet, underneath the other, or attached end of the permanent magnet. The electric current passes into the top induced magnet, then, by a strip of thin silver foil, into and along the permanent magnet; then, by a thin strip of thin silver foil, to the underneath induced magnet, whence it passes to the holder of the top electrode, and, through the lower electrode, to the battery.

The Induced Magnets.

Two induced magnets are fixed to the ends of a beam, which is free to oscillate up and down upon a central axis. One end of the beam is attached by a connecting rod to the socket of the top electrode, as before described. Two other induced magnets are permanently fixed to the framework carrying the beam; these are so disposed that their like poles come exactly opposite those of the magnets upon the beam, one being placed below the beam, the other above it. When a current of electricity is sent through these magnets, the effect produced is, that they repel each other, and thereby cause the requisite upward movement of the electrode.

By substituting an apparatus in which the arrangement of poles is reversed, the principle of attraction may be employed, instead of that of repulsion.

Calorific Agency.

A horizontal lever, centred on a pin, is attached by a coil of Newall's copper wire to the holder of the top electrode, while the other end slides up and down the side of a vertical standard, to which a spring is attached, which presses that end upwards, and, consequently, forces the top electrode down upon the lower one. Behind this standard, is a compound vertical rod, which is screwed at top, and fitted with a nut, which regulates a second spring fixed underneath it, for counterbalancing the effect of the first. This compound rod is composed of two pieces, which fit into a non-conducting bushing, and have between them a plug, which is ground flat on one side, so as to offer an insufficient amount of contact surface for the passage of the electric current, which causes the heating of the rod, and its consequent elongation, whereby, in consequence of these arrangements, the top electrode will be raised.

[The patentee describes next a modification of the foregoing arrangements, and refers to some illustrative figures upon a sheet of drawings which he has omitted to enrol, and in the absence of which this part of his not very intelligible specification becomes "confusion worse confounded."]

Decomposing Apparatus.

This apparatus consists of a case, horizontally divided into two compartments; in the lower one of which is placed a vessel containing the liquid to be decomposed, sulphuric acid and water. In this vessel is a cylinder, provided with an air-tight cover, into which is soldered a hollow tube, capable of being slidden up and down through the horizontal partition. The portion of hollow tube inside the top portion is provided with a button, and above that a hole fitted with a screw. Inside the cylinder are suspended two platina plates at about an inch and a half apart, which are connected respectively to the battery and to the holder of the lower electrode. The cylinder is kept in the required position by two springs pressing down upon the air-tight cover. As the gas is evolved from the liquid it will ascend the hollow tube, and a portion to be regulated by the screw will escape through the hole; while the remaining portion, unable to escape, will have the effect of lifting up the cylinder, hollow tube, and button. Under the button take the ends of two levers, centred upon two pins, having the end of one attached to the holder of the lower electrode, and the end of the other travelling over the face of a graduated quadrant. It follows that as the gas is generated, and according to the quantity allowed to escape at stated intervals of time, the button will be lifted with the hollow tube and cylinder, and consequently the free ends of the levers, whereby the bottom electrode will be drawn down from the top one, and the intensity of the current of electricity indicated on the scale.

The modes of regulating the supply of liquid to the battery are as follows:

1. A vessel is suspended inside an outer vessel, having a supply-pipe to the battery, and to one end of a weighted lever. The inner vessel contains the leg of a syphon which conducts the liquid, and the level of the top of it is slightly below that of the vessel of supply. When the density or specific gravity of the liquid increases, the equilibrium of the weighted lever is overcome, the inner vessel sinks, and the liquid flows over more rapidly into the outer vessel, and thence to the battery.

2. The rate of supply of the liquid may be regulated by means of a ball-cock.

Or the liquid may be supplied, when from a great distance, by hydraulic machinery.

Claims.—1. The use of a conductor or conductors of voltaic or other electricity, in combination with a permanent magnet or magnets.

2. The use of permanent magnets, combined with induced or temporary magnets.

3. The use of conductors so arranged as to produce neutral repulsion.

4. The arrangement and use of conductors and magnets, or of conductors only, in combination, and acted on by the attraction or repulsion of the electric current.

5. The arrangement of apparatus, in which the calorific effect of a current of electricity is rendered available to the regulation of electrodes.

6. The apparatus arranged and constructed so that the decomposing effect of an electric current may be made available to regulate the electrodes.

7. The use of the volta meter.

8. The arrangement of apparatus, by which the specific gravity, or degree of saturation or exhaustion, is made to regulate the supply of liquid to the battery.

9. The use of hydraulic machinery, which requires to be worked by "power or force" in combination with the voltaic battery.

WILLIAM WILKINSON NICHOLSON, Acton-street, Gray's Inn-road, C. E. *For improvements in machinery for compressing wood, and other materials requiring such a process.* Sept. 28, 1849.

The improvements sought to be secured under this patent, refer to the manufacture of wooden wedges, trenails, and pins for railway and other like purposes. The patentee states, that it has been before proposed to manufacture these articles from wood, by compressing them into hard masses, of the required shape, and thereby destroying the elasticity of the wood; but that his invention has for its object to compress them without destroying the elasticity, so that when placed in a favourable situation, that is, one exposed to damp, they may recover their elasticity, and return, except when prevented by force, to their former size. The wood to be operated upon is cut and thoroughly dried, and then subjected to the action of either of the following machines, according to the form to be given to it.

The wedge compressing machine consists of a frame-work, which supports a reciprocating table, worked from the main shaft. In front of the table, and on either side, are a pair of dies, of the necessary material, formed for shaping the wedges, and between them works a vertical shaft, driven up and down by a cam keyed on the main shaft. The top of the vertical shaft is connected by links to the pistons of the plungers of the die boxes. On motion being communicated to the main shaft, the reciprocating table travels forwards, and forces the pieces of wood which have been previously placed in front of it, under the die boxes. The cam, acting upon the end of the vertical shaft, lifts it up, and forces the links and pistons of the plungers into the same right line, and consequently the plungers into their respective die boxes, whereby the pieces of wood, contained therein, are compressed into the required shape. When the shaft descends, the plungers are withdrawn, and the wedges displaced by the entry of the next succeeding pieces of wood.

The Rolling and Planing Machine consists of a series of pairs of rollers, capable of having the distance between each pair regulated by adjusting screws. The wood is conducted to the first pair of rollers, which lay hold of it, and force it through the other pairs of rollers successively, whereby it is compressed into the required shape, after which it is caused to pass, by the pressure of the succeeding piece of wood, underneath plane irons, to remove any superfluity which may be upon its surface.

The Railway Pin and Treenail Compressing Machine consists of a framework, which supports a reciprocating table, worked by a crank-shaft, and a revolving table, having the die-boxes cast in or attached to it. There are two pair of die-boxes placed in exactly opposite parts of the periphery of the table, and with the narrow ends inwards. The revolving table is caused to make one half revolution for each backward motion of the reciprocating table, so that each pair of die-boxes may be successively brought in front of it.

On motion being communicated to the machine, the reciprocating table travels forwards, and forces the pieces of wood, which have been previously placed before it, into one pair of die-boxes. When the reciprocating table travels backwards, the revolving table makes one half a revolution, and brings the other pair of die-boxes into position ready for the succeeding operation. The forcible entry of the pieces of wood into the second pair of die-boxes, will have the effect of driving those in, the first out. In order to diminish the chance of fracture to the different parts of the machine from the suddenness of this shock, it is proposed to place a spring buffer in between the inner ends of the pairs of die-boxes. The spring buffer consists of a cylinder, in which is placed a spring of vulcanized India rubber. The ends of a number of rods rest against either side of the spring, and have their other ends exactly opposite the ends of the pins in the die-boxes, so that as one pair of pins is driven into the die-boxes, they will act upon their rods, and through the caoutchouc upon the opposite rods, which will enter their respective die-boxes, and thereby force out the pins which have been already formed.

Claims.—1. The general arrangement of machinery for compressing wedges laterally, for railway and other purposes, by forcing

the pieces of wood of which they are to be made into fixed dies (without destroying the elasticity, and displacing them by the entry of a fresh supply.

2. The general arrangement of machinery for compressing the pieces of wood between rollers into the required shape, and removing any superfluity by forcing them at the same operation under plane irons.

3. The general arrangement of machinery for compressing pins and treenails by forcing the pieces of wood of which they are to be composed into dies cast in or attached to a revolving table, so that the entry (for compression) of one set of pins or treenails shall force out the other set, which has been already compressed.

4. The use of the spring buffer.

ANDREW PATON HALLIDAY, Manchester, manufacturing chemist. *For certain improvements in the manufacture of pyroligneous acid.* Patent dated Sept. 28, 1849.

The patentee remarks, that it has hitherto been customary to manufacture pyroligneous acid from branches or billets of oak, or from sawdust, shavings, and the like enclosed in an iron retort, to which heat is applied from the exterior, and its contents thereby carbonized; but that, in consequence of the minute division of the particles of wood, those next the iron become charred and bad conductors of heat, while those in the centre are not carbonized at all. Now the object of this invention is to obviate this difficulty, by exposing the pieces of wood successively to the action of the heated surfaces of the retort; and this is proposed to be effected by the following arrangement of apparatus:—A number of horizontal iron retorts are fixed in a furnace, with their ends projecting outside; one end of each retort takes into a vertical pipe, which opens at bottom into a water vessel, and at top into a main communicating with the condensers. The other end of each retort opens into a vertical feed-pipe, to which the sawdust or other material to be carbonized, is supplied by a hopper. In the supply-pipe, and extending nearly the whole length, is a vertical screw, and in the retort a horizontal screw likewise extending its whole length. Both screws are worked from the outside, and at any required velocity, through the intervention of toothed gearing from a prime mover. The vertical screw receives the materials, and supplies them at a regular rate to the horizontal screw, which brings their particles successively into contact with the heated surfaces of the iron retort, and finally delivers them whence carbonized into the vertical pipe, whence they fall into the water vessel. The pyroligneous acid escapes at the same time, in the form of vapour, from the retort up the vertical pipe, and through the main, into the condenser, where it is condensed in the ordinary manner.

When the pyroligneous acid is to be manufactured from large pieces of wood, such as branches or billets of oak, &c., it is proposed to place them in an open cylinder, composed of strong wire, and to inclose it inside a strong iron cylinder. Heated air is then driven through, so as to carbonize the wood, after which it escapes with the pyroligneous acid thus evolved into the condensers.

Claims.—The manufacture of pyroligneous acid from sawdust, wood shavings, chips, leaves, spent dyewoods, refuse tan, peat, and other vegetable and ligneous substances, by causing them to pass with a continuous motion through retorts.

2. The manufacture of pyroligneous acid from sawdust, wood shavings, chips, leaves, spent dyewoods, refuse tan, peat, or other vegetable and ligneous substances, by the application or employment of the machinery described.

3. The manufacture of pyroligneous acid from branches or billets of oak, &c., by the application of heated air.

MR. G. WARREN'S HYDROSTATIC PRESSURE ENGINE.

Sir,—There was a letter in your Magazine a week or two ago from Mr. Warren, describing a hydrostatic engine which he gives as his own invention.

The other day I was looking over an old volume of the *Mech. Mag.*, and to my astonishment I found in the Number dated March 20, 1824, a letter proposing the very same thing, and signed, F. J—k—n.

F. Y. W.

WEEKLY LIST OF NEW ENGLISH PATENTS.

John Macintosh, of Bedford-square, for improvements in furnaces and machinery for obtaining power, and in regulating, measuring and registering the flow of fluids and liquids. March 24; six months.

Alexander Parkes, of Harborne, Stafford, chemist, for improvements in the deposition and manufacture of certain metals and alloys of metals, and improved mode of heating and working certain metals and alloy of metals, and in the application of the same to various useful purposes. March 26; six months.

John Mason, of Rochdale, Lancaster, machine maker, and George Collier, of Barnsby, York, manager, for certain improvements in machinery or apparatus for preparing and spinning cotton, and other fibrous materials, and also improvements in the preparation of yarns, or threads, and in the machinery or apparatus for weaving the same. March 26; six months.

Stephen White, of Victoria-place, Bury New-road, Manchester, gas engineer, for improvements in the manufacture of gases, and in the application thereof to the purposes of heating and consuming smoke, also improvements in furnaces for economizing, heat, and in apparatus for the consumption of gases. March 26; six months.

David Henderson, of the London Works, Renfrew, Scotland, engineer, for improvements in the manufacture of metal castings. March 26; six months.

George Thomson, of Camden-road, cabinet maker, and James Elms, of the New-road, gentleman, for improvements in machinery for cutting and tying up fire-wood. March 28; six months.

William Buckwell, of the Artificial Granite Works, Battersea, Surrey, civil engineer, for improvements in compressing or solidifying fuel and other materials. March 28; six months.

Richard Satchell, of Rockingham, Northampton, for improvements in machinery for depositing seeds, and hoeing and working land. March 28; six months.

Pierre Rene Guerin, of Havre, for improvements in steering ships and other vessels. March 28; six months.

Charles Green, of Birmingham, patent brass tube manufacturer, and James Newman, of Birmingham, manufacturer, for improvements in the manufacture of railway wheels. March 28; six months.

James Thomson Wilson, of Glasgow, for improvements in the manufacture of sulphuric acid and alum. March 28; six months.

George Henry Manton, of Dover-street, Piccadilly, gun maker, and Josiah Harrington, of Regent-circus, for improvements in priming, and in apparatus for discharging fire-arms. March 28; six months.

William Norton, of Lascelles Hall, Lepton, York, fancy cloth manufacturer, for certain improvements in the production of figured fabrics. March 28; six months.

François Vanillon, of Princes-street, Hanover-square, manufacturer, for improvements in making hats, caps, and bonnets. March 28; six months.

William Hartley, of Bury, Lancaster, engineer, for certain improvements in steam engines. March 28; six months.

John Britten, of Birmingham, manufacturer, for certain improvements in the means, apparatus, and appliances for cooking, preserving, preparing, and storing drinks and articles of food, and in preparing materials for constructing the same; also in constructing vertical roasting jacks and chains for the same, applicable to other chains, parts of which improvements are applicable to other similar purposes. March 28; six months.

James Lawrence, the Elder, of Colnbrook, Middlesex, brewer, for an improvement or improvements in brewing worts for ale, porter, and other liquors, and in storing ale, porter, and other liquors. March 28; six months.

William Beckett, of Northwich, Cheshire, draper, and Samuel Powell, of Witton, in the same county, foreman, for certain improvements in the manufacture, making, or construction of certain articles of wearing apparel. March 28; six months.

James Fletcher, of Salford, Lancaster, manager, and Thomas Fuller, of Salford, aforesaid, machinist and tool maker, for certain improvements in machinery, tools, or apparatus for turning, boring, planing, and cutting metal, and other materials. March 28; six months.

Osborne Reynolds, of Dedham, Essex, clerk, for certain improvements in railways. March 28; six months.

Thomas Harrison, of Liverpool, merchant, for certain improvements in the construction of baking ovens, and also certain machinery for working or using the same. March 28; six months.

Henry Howard, of Railway-place, Fenchurch-street, London, for certain improvements in the manufacture of glass, also in the construction of furnaces for melting and fining the same. March 28; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for a certain improvement or improvements in the construction of wheels. March 5; six months.

Robert Jobson, of Holly Hall Works, near Dudley, Stafford, engineer, for improvements in the manufacture of stoves. March 5; four months.

John Smith, of Hare Craig, Dundee, factor to Lord Douglas of Douglas, for improvements in the manufacture of flour, applicable in the making of bread, biscuits, and pastry. March 6; six months.

William Edwards Staite, of Throgmorton-street, London, civil engineer, for improvements in the construction of galvanic batteries, in the formation of magnets, and in the application of electricity and magnetism for the purpose of lighting and signalizing; as also, a mode or modes of employing the said galvanic batteries, or some of them, for the purpose of obtaining chemical products. March 7; six months.

Charles Thomas Pearce, of Park-road, Regent's-park, Middlesex, esq., for improvements in apparatus for obtaining light by electric agency. March 7; six months.

Richard Laming, of Clichy la Garonne, France, chemist, for improvements in the modes of obtaining or manufacturing sulphuric acid. March 9; six months.

George Nasmyth, of Great George-street, Westminster, civil engineer, for certain improvements in the construction of fire-proof flooring and roofing, which improvements are also applicable to the construction of viaducts, aqueducts and culverts, March 12; four months.

Thomas Henry Russell, of Wednesbury, patent tube manufacturer, and John Stephen Woolrich, of Birmingham, chemist, for improvements in coating iron, and certain other metals and alloys of metals. March 13; six months.

George Ferguson Wilson, of Belmont, Vauxhall, gent., for improvements in separating the more liquid parts from the more solid parts of fatty and oily matters, and in separating fatty and oily matters from foreign matters, and in the manufacture of candles and night lights. March 13; six months.

Charles Robert Collins, of Brunswick-street, Glasgow, paper manufacturer, for a certain improvement or improvements in the manufacture of paper March 14; four months.

John Hick, of Bolton-le-Moors, Lancaster, engineer, and William Hodgson Greatrix, of Salford, Lancaster, engineer, for certain improvements in steam engines; which improvements are more particularly applicable to marine engines; and also improvements in machinery or apparatus for propelling vessels. March 16; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in engines or apparatus, principally designed for pumping water. March 19; six months.

William Galloway, and John Galloway, of Knott Mill Ironworks, Hulme, Manchester, Lancaster, engineers, for certain improvements in steam engines. March 21; four months.

Thomas Robinson, of Leeds, York, flax-dresser, for improvements in machinery for breaking, scutching, cutting, hackling, dressing, combing, carding, drawing, roving, spinning, and doubling flax, hemp, tow, wool, silk, and other fibrous substances, and in the uniting fibrous substances. March 21; six months.

LIST OF SCOTCH PATENTS SEALED FROM FEBRUARY 22, TO MARCH 22, 1849.

Samuel Wellman Wright, of Chalford, Gloster, civil engineer, for certain improvements in preparing various fibrous substances for spinning, and in machinery and apparatus connected therewith. February 27; six months.

Michael Loam, of Treskerley, of Gwennap, Cornwall, engineer, for improvements in the manufacture of fuzees. February 28; six months.

LIST OF IRISH PATENTS SEALED SINCE THE 20TH OF FEBRUARY, 1849.

William Martin, of St. Pierre les Calais, France, mechanist, for certain improvements in machinery, for figuring textile fabrics, parts of which improvements are applicable to playing certain musical instruments, and to printing, and other like purposes. February 21; six months.

NOTICES TO CORRESPONDENTS.

A Reader.—*Shaw's patent for a paging machine is dated March 3, 1845.*

A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the Claims of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d. Post Office Orders to be made payable at the Strand Office, to Joseph Clinton Robertson, of 166, Fleet-street.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99a, New-street, Birmingham.—Sold by A. and W. Galignani Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

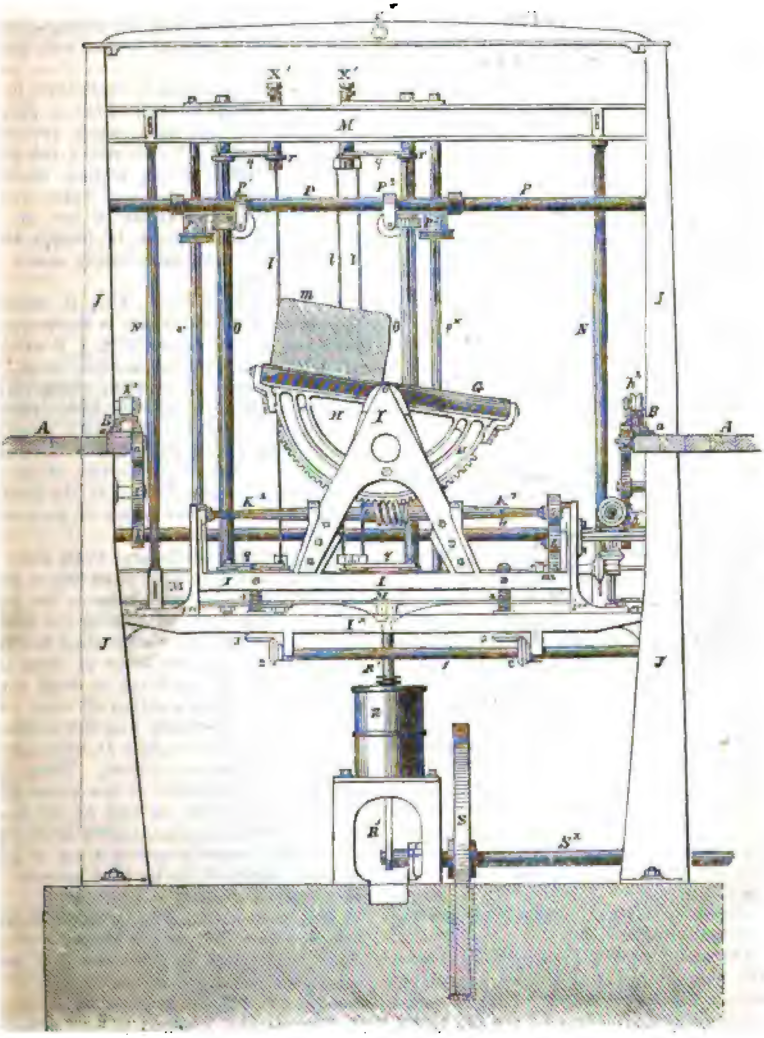
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1339.] SATURDAY, APRIL 7, 1849. [Price 3*d*, Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

COCHRANE'S PATENT TIMBER-SAWING MACHINERY.

Fig. 1.



The celebrity which this machinery has acquired through the legal proceedings of which it has been the subject (see vol. xlix., p. 590), has led to our being favoured with a great many applications—from the Continent more especially—for a fuller explanation of the details of its construction, than it entered into the scheme of the report of these proceedings to furnish. We are glad, therefore, to have it now in our power to lay before our readers a set of engravings of the machinery, which have been carefully prepared under Mr. Cochrane's own inspection, and exhibit it in its most perfect state—not merely as described in his English specification, but as it has been since improved in many important particulars. We shall take the specification for the groundwork of our description, and deviate from it only when this may be rendered necessary by the modifications introduced by the inventor.

Fig. 1 is a front or end elevation of the machine; fig. 2 is a side elevation; fig. 3 a plan; fig. 4 is a transverse section through the chuck-plate wheel; and fig. 5 is a detached view of part of the steam machinery.

A, A, A, are the stationary framing or sills upon which the sliding carriage of the mill is mounted. They are firmly fixed, in the usual way, upon the ground, or upon masonry in the building in which the mill is intended to be placed. Two longitudinal rail plates, *aa*, of the usual description, having V edges on their upper sides, are securely fixed upon the horizontal longitudinal sills or beams of the framing, and upon the V edges of these rail plates the sliding carriage moves in the usual way, for the purpose of advancing any piece of wood which it may carry up to the saw or saws, in order that it may be cut into the required shape or shapes.

The sliding carriage in or upon which is to be placed any log or piece of wood intended to be cut, consists of two longitudinal bars, BB (which form the base of the carriage), placed parallel to each other, and braced together into the form of a rectangular frame by the transverse rod, *b*, and the head block or plate, CC.

The under sides of the longitudinal bars, BB, have each a longitudinal groove extending the whole length of the carriage, and fitted to the V edges of the rail plates, *aa*, so that the carriage may slide easily and securely along in the ordinary way.

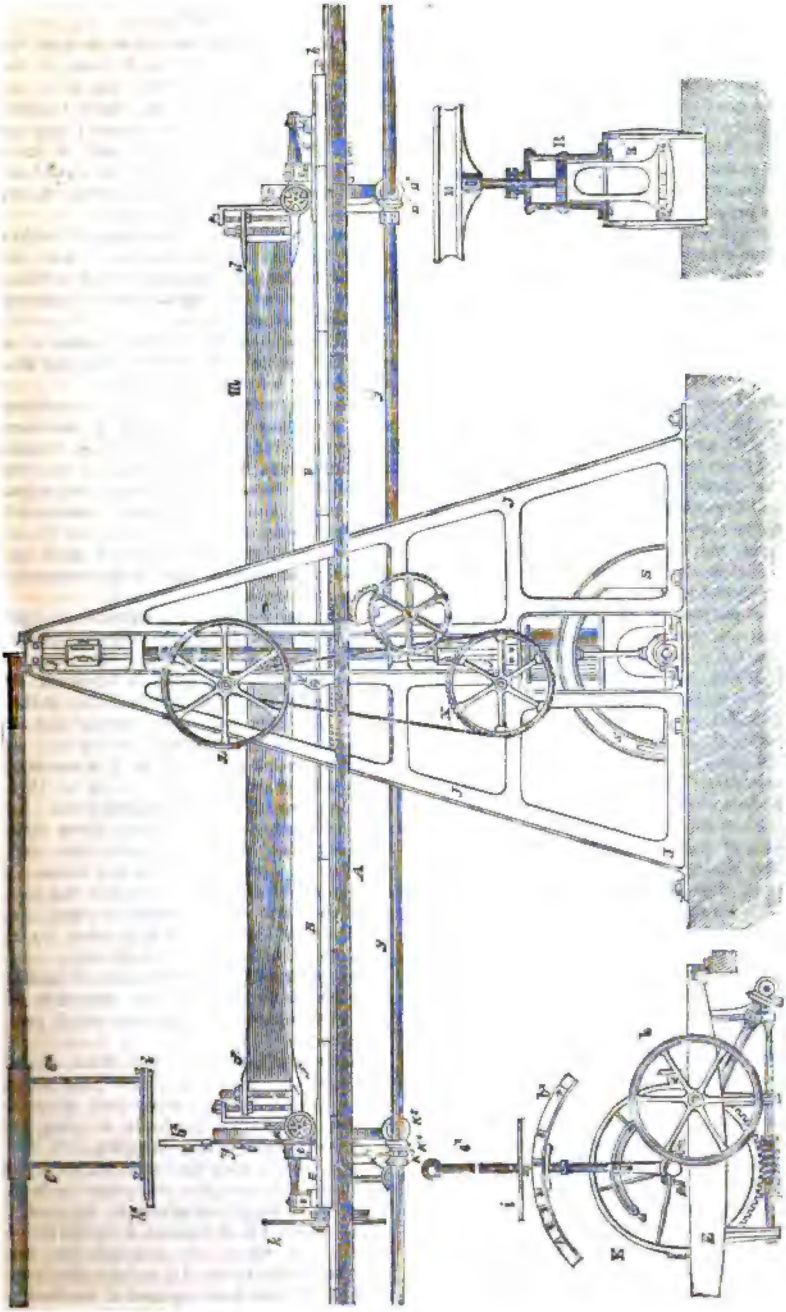
There are also on the under sides of the longitudinal bars, BB, two toothed racks, extending along the whole length of the carriage. These racks are placed parallel with the grooves before mentioned, and so that a pair of pinions, *hh'*, may, when a piece of timber is to be cut, move the carriage along upon the rail plates, *aa*, by means of trains of wheels connected with the pinions. And when the piece of timber has been cut, the machinery may be thrown out of gear, and the sliding carriage moved back by any of several well-known means.

The sliding carriage is kept down in its proper position by two friction rollers, h^2 h^2, one on each side, which have their edges fitted to the V rails which run along the upper sides of the sliding carriage, as aftermentioned. Each of these rollers is attached to the inside of one of the standards or fender posts, JJ, (within which the sawgate works immediately above the sliding carriage.)

Upon the head block, CC, is mounted the poppet head, *cc*, which is made capable of being moved laterally in a dovetailed groove, for the purposes of adjustment. In this poppet head is an axle, which carries the chuck plate, D, and this chuck plate is made capable of turning freely upon its axis. This chuck plate has a dovetailed groove extending across the face of it, and having fitted into it the foot of the jaws or clips, *dd*, the lower of which is made fixed and the other moveable.

The moveable jaw is kept in its place by two bolts, and by a nut; upon one of these bolts it may be screwed towards the other jaw, for the purpose of holding one end of a log of wood or piece of timber firmly in the carriage. And the lower or fixed jaw, or clip, must be mounted in such a way that the inner surface will at all times coincide with an imaginary line drawn across the face of the chuck plate, D, and through the centre of the axis thereof. These jaws or clips may, by means of the screw shaft, *g*, be moved across the face of the chuck plate in either direction, as may be required for the purpose of balancing a log or piece of wood, which is to be held between the chuck plates whilst it is being cut.

The head block, EE, is mounted upon the side bars, BB, of the sliding carriage. Along the tops of the side bars, BB, are V edges, and under and across the ends of the head block, EE, are grooves to receive the last mentioned V edges, so that the head block, EE, when placed across the sliding carriage, with its grooves upon the same V



Side Elevation.

Fig. 3.

Fig. 4.

Fig. 5.

edges, may slide easily along, above, or upon the tops of the sliding carriage, in the direction which may be required for the purpose of adjustment, according to the length of the log or piece of timber to be cut.

The head block, EE, has motion given to it (along the carriage) by means of a pair of pinions, which are fixed upon a transverse shaft under the head block, and which serve the purpose of keeping the head block down in its proper position on the carriage. This transverse shaft forms the axis of each of the last-mentioned pinions, and the bearings of the shaft (in which it is made to turn by means of a hand wheel, handle, or other convenient means,) are fastened to the under side of the head block, EE. The last mentioned pinions are placed in such a position that the teeth of these pinions take into the teeth of the toothed rack, which is placed upon the under sides of the longitudinal bars, BB, as before mentioned; and as the pinions are turned round in the one direction or the other, the head block, EE, will be moved towards the one end of the sliding frame or the other.

Upon the head block, EE, is mounted a poppet head, *ee*, which is made capable of being moved laterally in a dovetailed groove, for the purpose of adjustment, in like manner as the poppet head, *cc*, on the head block, CC. In this poppet head, *ee*, is an axle, which carries a toothed wheel, K, to which is attached the chuck plate, F, and this wheel with the chuck plate is made capable of turning upon its axis. This chuck plate has a dovetailed groove extending across the face of it, and having fitted into it the foot of the adjustable jaws or clips, *ff*, which are intended to hold the other end of the log of wood or piece of timber placed in the sliding carriage to be cut. These jaws or clips are constructed and mounted in or upon the chuck plate, F, in like manner as the jaws or clips, *dd*, which are mounted in or upon the chuck plate, DD.

The fixed and moveable jaws of the clips may be made also with quadrant slots, in order that the moveable jaw or clip may be capable of being turned to one side or the other, so as the better to grasp and hold the end of any irregularly formed end of a piece of timber.

In each of these figures there is represented a log or piece of timber, *mm*, held in the sliding carriage by means of the jaws or clips, showing its appearance after it has been submitted to the action of the saws, and had two of its sides cut so as to make it externally of the required shape.

To place a log or piece of timber in the sliding carriage in a proper position for being cut, one end of it must be placed between the jaws or clips of the chuck plate, D, which is mounted on the fixed head block, *cc*, and the moveable head block, EE, being then moved to a proper position for enabling the jaws or clips of the chuck plate, F, to receive the other end of the log or piece of timber,—that end of the log or piece must then be placed between those joints or clips. The nut of the screw-bolt of each pair of jaws or clips is then to be turned so as to bring the moveable jaw or clip down upon the log and hold it securely.

In the place of the roller which is ordinarily used in sawing mills or machines, for the purpose of supporting a log or piece of wood, at an intermediate point between the ends, and near to the saws of the mill, an oscillating cylindrical roller is used, or a roller having its axis capable of being deflected from a horizontal position.

This roller support is placed at a position as near as conveniently may be to the saws of the mill, and in front thereof, and must be independent of, and separate from, but within the frame of the sliding carriage. This roller, and the machinery connected therewith, may be supported by any framing, or other convenient means, upon the ground, or in connection with the stationary framing of the mill.

G (fig. 1), represents a cylindrical iron roller mounted upon an axle in an oscillating segment piece, H. This segment piece is supported by an axle, stud, or trunnion, at each side thereof, which is mounted in the frame, H; these axle studs being placed at right angles with the axle of the roller.

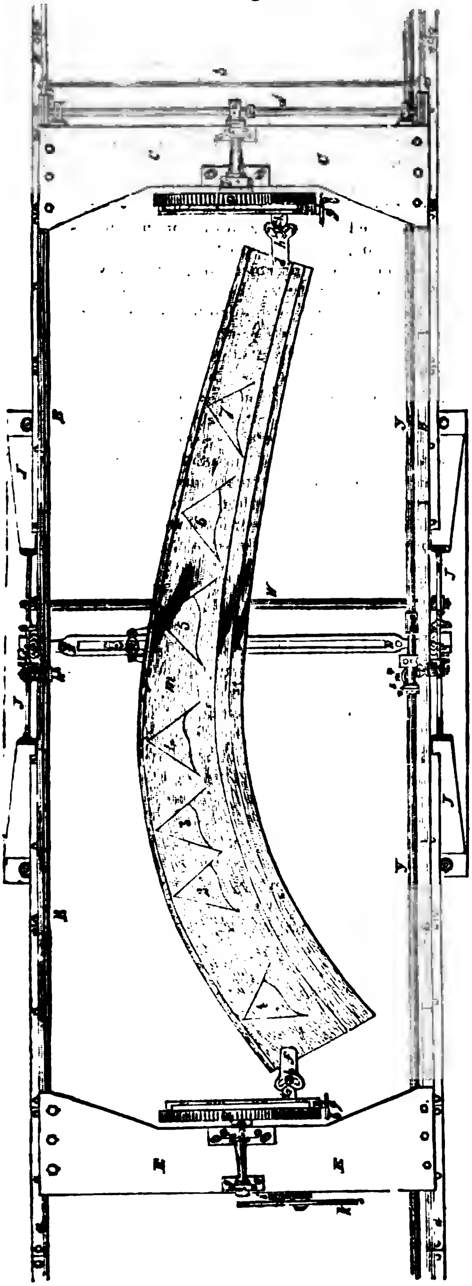
The segment piece, H, has the semicircular edge thereof toothed, so as to take into the threads of the endless screw, L, and the segment piece is held down by a quadrant slot in the segment piece, and working on a pin or pins in the frame, I, so as to allow of the oscillation of the segment piece for the purpose of varying the deflection of the axis of the roller, G, in any manner which may be required.

The quadrant slot is to be made of a sufficient length to allow of the deflection of the roller support to any extent which may be requisite.

Each side of the frame, I I, is fitted within two upright supporters, *i***, *i***, the sides of the frames having longitudinal grooves or slots to receive the ends of pins to be driven through the uprights into the grooves, so as to keep the frame, I I, securely within its two uprights, and yet allow it to be varied or depressed as may be required.

The frame, I I, is supported by two jack-screws, 4, 4, which are threaded into the lower part of the frame, I I, and the shoulders of these screws work against a stationary rail or bar, I*, which is firmly fixed to the stationary framing, or foundation of the mill.

Fig. 2.



The lower ends of the jack-screws are furnished with bevel wheels, 3, 3, which respectively take into two bevel wheels, 2, 2; and the bevel wheels, 2, 2, are fixed upon a transverse shaft, 1, which may be turned by a handle or other convenient means. By turning the shaft, 1, the bevel wheels will be put in motion and the jack screws turned, and as these screws are turned the one way or the other, the frame, I I, may be raised or lowered as may be desired. By these means the frame, I I, and the roller, G, may be lowered so as to remove the roller, G, out of the way when desirable so to do; and by raising the frame, I I, and roller, G, the roller may be elevated in such a way as to form an intermediate support to a log or piece of wood whilst the saws are cutting it.

If the pieces of wood intended to be cut in a mill, should happen to be of such a description that they will not be held sufficiently steady during the operation of sawing by one intermediate roller support, such as before described, the same mill may be constructed with an additional oscillating roller support (similar to that before described), and capable of being raised and lowered as before mentioned, and such additional oscillating roller support may be placed behind the vertical saws, or in any other position which may be found desirable, for the farther or better supporting the pieces of wood to be cut in the mill.

Pieces of wood for shipbuilding, and for various other purposes, frequently require to be cut into irregular shapes, and for the purpose of preparing such pieces of wood of the desired shapes, it is often necessary that one or more of the surfaces thereof should be cut with a varying bevel or surface, or with a surface cut in a twisting or winding manner, the bevel or direction of a cut, or cuts, constantly varying, either regularly or irregularly, in one or more than one direction as the cutting proceeds.

The saws of a vertical saw mill cannot, as such mills are usually constructed, be moved out of their perpendicular position, to either the one side or the other for the purpose of varying the bevel or surface of a log, or piece of timber, which they are cutting.

This object may, however, be attained by gradually turning a log, or piece of timber, which has been placed in a mill to be cut in the requisite direction, or directions, as the operation of sawing proceeds.

For the purpose of being enabled to turn a log, or piece of wood, during the cutting thereof, this improved sawing machine is constructed with revolving chuck plates

and oscillating segment pieces, with roller support, or supports, as before described.

These chucks and the intermediate roller support, or supports, may be turned in the manner required by the hand, or by any convenient machinery effecting that object, such as that now about to be described.

The teeth of the wheel, K, behind the chuck plate F, take into an endless screw L, as shown in fig. 4, which is fixed upon a transverse shaft, K^1, and in like manner the teeth of the oscillating segment piece, H, take into the endless screw, L^2. The chuck plate, D, may, if it should be thought desirable, be furnished with a rim of teeth taking into an endless screw in like manner; but a machine will work sufficiently well for all ordinary purposes without this addition to the machine as represented in the figures.

When a log or piece of wood has been placed with its ends in the jaws or clips of the turning chuck plates, the roller support, G, must be raised until the upper surface thereof comes in contact with the log; and the mill or machinery must be put into gear in such a way that the direction and degree of the inclination (if any) of the axis of the roller support, G, to the horizon must at all times be the same as that (if any) of the face of the fixed jaw or clip of the chuck plate, F.

The chuck plate, F, and the segment piece, H, must at all times be turned together in the same direction, and in the same degree, or with the same speed; and the chuck plate, D, being left free to turn upon its axis, will be turned as the log or piece of wood may be turned.

Upon the end of the driving shaft, K^1, of the endless screw taking into the teeth of the chuck wheel, K, is fixed a bevel wheel, K^3, taking into another bevel wheel, K^4, upon the driving shaft, y, which last mentioned wheel is prevented from turning upon the shaft by means of a feather or key in the boss of the wheel, which takes into a groove along one side of the shaft, y. For the purpose of preventing the shaft, y, from springing, and also for keeping the bevel wheel, K^4, in gear with the other bevel wheel, K^3, a collar, K^5, is fitted upon the boss of the bevel wheel, K^4 (within which collar the boss of the wheel turns freely;) and the collar is attached by its arm to the under side of the head block, E.

The boss of the wheel, K^4, is kept in its place within the collar, K^5, by a narrow collar fastened upon the outer end of the boss by a set screw.

And as the head block, E, on the sliding carriage, with the same head block, is moved along in either direction, the bevel wheel, K^4, which the shaft, y, turns, will be moved along at the same time, and kept in gear with the other bevel wheel, K^3, with which it is intended to work.

The driving shaft, K^2, has its bearings in the moveable frame, II, with which it must rise and fall. One end of this driving shaft passes through its bearings in one side of the frame, I I, and through the next adjoining upright, i^{**}, in which a slot is cut, so that the shaft, K^2, may pass up and down within the slot, as the frame, I I, rises and falls. The shaft, K^2, has its outer end fitted into a hole or bush in the collar upon the boss of the wheel, so that the collar must be raised or lowered in like manner as the end of the axle which works within the said bush or hole.

Upon or near to the end of the shaft, K^2, which is next to the collar, is fixed a bevel wheel, which takes into another similar bevel wheel. The bevel wheel, with its long boss below it, is placed upon an upright driving shaft, which has a groove or key-way cut along one side of it, to receive a feather placed in the inside of the boss of the bevel wheel, which is made to move freely up and down within the groove.

The bevel wheel and its boss move freely up and down upon the shaft, and the boss of the bevel wheel, which turns freely within the collar, are kept securely within that collar by means of a narrow collar fastened upon the end of the boss by a set screw, in the usual manner. The bevel wheels are thus at all times kept in gear with each other.

The shaft has its bearings at the foot in a socket or step, and at the top in a bracket, as shown.

Upon the top of the shaft is fixed a bevel wheel, which takes into another bevel wheel fixed upon the shaft, y.

The boss of the bevel wheel, n^5, is made to move in a bearing or bush at one end of a bracket or arm, within which the boss turns freely, and the bracket or arm is fixed to the frame, I^*, and by these means the shaft, y, is kept steady, and in its proper position whilst in motion.

When the driving shaft, y, is left at rest, the moveable chuck plate, F, and the segment piece, H, with the roller, G, will also be left in a state of rest; that is, they will not be turned either to one side or the other of the machine. And when it is unnecessary that a log or piece of timber should be turned in either direction during the process of cutting, for the purpose of producing a piece of wood of the intended shape, then the chuck plates and roller support are to be

left in a state of rest; and if the chuck plates and roller support are turned by machinery, as shown in the figures, then also the driving shaft, y, and all the machinery connected therewith and before described, are to be left in a state of rest.

But when it is necessary that a log or piece of timber should be turned during the process of cutting, then that may be done by hand, as before mentioned; or if the machine be such as before described, then motion is to be given to the shaft, y, and such motion regulated and (when necessary) accelerated or retarded by the machinery next to be described. And whenever motion is given by means of the driving shaft, y, to the transverse driving shaft, K^1, and the moveable chuck plate, F, a similar motion will, by means of the train of wheels before described, be also communicated to the transverse driving shaft, K^2, and the segment piece, H, carrying the roller support, G.

(To be continued next week.)

FLOATING BREAKWATERS.—SIR SAMUEL BENTHAM'S EXPERIMENTS.—THE PLANS OF CAPTAIN TAYLER, MR. SMITH, ETC.

Floating breakwaters appear to have been condemned without a due discrimination of those cases in which they are appropriate from those in which they would be totally ineffectual. It seems self-evident that no construction of this nature could avail where, as at Dover, shingle travelling along the ground has to be guarded against; but, under certain other circumstances, such as where a roadstead has to be protected against sea waves, no plausible objection to floating breakwaters has yet been made public; whilst, on the contrary, evidence exists of the all-sufficiency of such a structure, though, perhaps, the fact may be but little known.

The first introducer in this country of a floating breakwater on a small scale at Sheerness, and proposer of an extensive one at Plymouth (it is perhaps needless to say), was Sir Samuel Bentham; on that occasion he had a rough little model made, of a form he thought suitable, which model in January, 1812, his representative presented for the United Service Museum, accompanying the trifle with a letter to the secretary of the institution, giving a short account of the origin of the invention, part of which communication was as follows:

"The idea of this floating breakwater was taken from machines of the same nature, but on a comparatively very small scale, which Sir Samuel saw in use in the port of Revel, autumn, 1807. These small breakwaters were the invention of Monsieur Norberg, a Danish engineer, employed at that time by the Russian Government to construct a pier at Revel, where, finding the work much impeded by the force of the waves, he introduced floating breakwaters to protect his works and workmen. I happened to be in the boat with Monsieur Norberg and Sir Samuel when he went to examine the works, so that I can describe these breakwaters from my own recollection. They were triangular prismatic frames of wood, the length of each frame that of a deal, say 12 or 14 feet; one side of the frame, that towards the sea, had nailed upon it, longitudinally and close together, whole deals, so that little or no water could pass between deal and deal. I remember the effect was very satisfactory, as within them we were in smooth water, whilst without, the waves were beating violently.

"Sir Samuel was in the habit of generalizing ideas; consequently, on his return to England, he paid much attention to the effect of bodies floating on water in arresting the force of waves; amongst other instances, to the effect of a boom in Portsmouth Harbour, to protect the part of it contiguous to the dockyard, where boats were kept afloat; and he was satisfied that floating breakwaters, on a large scale, would prove perfectly efficacious, and that they would be found to possess many advantages besides those of economy.

"In considering the most advantageous mode of constructing floating breakwaters, he conceived that the mode shown by the model was most likely to prove the cheapest, and the best calculated to produce the desired effect. He had observed at Revel that the waves, when very violent, on rising up the closed side of the breakwater, were apt to tumble over it, instead of curling back to seaward; whereas it seemed reasonable that a wave dashing up a side like that of the model, would be broken in its progress by the irregular surface produced by the want of contiguity of the baulks, that the crossing of these baulks at the top would tend to throw back a wave to seaward, and farther,

that such portion of a wave as passed through the seaward line of baulks, would have to encounter the back row of them, placed opposite the spaces in the front row; however, had the idea been adopted, doubtless he would have submitted to the Admiralty the expediency of constructing preliminary floating breakwaters on a small, inexpensive scale, so as to prove the comparative efficacy of different variations in the details of structure."

Absence from England is then given in excuse for not having presented the model to the secretary long before. It was to Monsieur Norberg and to Revel that allusion was made in Sir Samuel's proposal, when he said he had "seen breakwaters constructed on the same principle in a foreign port."

The port of Revel in many respects resembles Plymouth Sound, excepting that it is with southerly winds that the Sound is annoyed, whilst at Revel, winds from the north bring the heaviest seas, and, at such times, the force of the waves at Revel is truly formidable.

Mr. W. H. Smith's arguments in favour of his variety of floating breakwater, apply equally to all floating breakwaters, the "yielding principle" being common to them all; the merits of the form he recommends cannot be judged of by what appears in the *Mechanics' Magazine;* but his manner of mooring the floats seems different from any before proposed. Mitchell's screw piles would doubtless be secure, and the balance weights proposed might, in moderate seas, prevent a float from deviating much from the upright; but, in severe gales, and in such a place as Plymouth Sound, whether any weight that could be attached as proposed, would prove sufficient for the purpose, seems doubtful. There is, however, one reason why anchors and chain cables might in many cases be preferable for mooring the floats, as was stated by Sir Samuel in his proposal, Oct. 1811,* "they may be tried in different parts of the harbour till experience shall have pointed out the most advantageous situation for them; or they might be entirely taken away, and be employed elsewhere, whenever circumstances might render it desirable;" and the anchoring the float at the four corners of the prism, as he proposed, answered the purpose of Mr. Smith's balance weights.

The destruction of Captain N. Tayler's floats, at Brighton, is nowise decisive against floating breakwaters otherwise constructed: his floats were of an unmechanical form, so that they required heavy metal work to bolt the parts together. They were at last dashed to pieces; but whilst they lasted, smooth water was preserved within them during the heaviest gales. Captain Tayler also sent a floating breakwater to Ceuta, which proved useless: the soundings that had been furnished him were either incorrect, or he had mistaken them; for the breakwater was too large to float in the desired place. Thus it often happens that a principle, good in itself, is condemned from erroneous modes having been adopted for carrying it into execution.

The small cost of floating breakwaters compared with that of a fixed one, as usually constructed, renders their introduction highly desirable—the whole expense of a floating breakwater not amounting to more than a year or two's interest on the capital usually sunk for a fixed one. This, like so many other of Sir Samuel's inventions and expedients, will doubtless, sooner or later, be adopted. Very lately the mode which he devised for ascertaining the nature of the soil and substrata at Sheerness,* has been most successfully employed by Mr. Brunel. A newspaper paragraph† relates, that the construction of a bridge across the Tamar, of the clear width of 300 feet, and clear height of 100 feet above high water, "had been declared impracticable and visionary." "To ascertain whether there was a proper foundation for the piers, and in what way it would be best to keep out the water, so as to get that foundation laid, Mr. Brunel ordered a wrought iron cylinder to be constructed of ½ inch boiler plates, riveted together like the boiler of a steam engine. This cylinder was 6 feet in diameter, 85 feet long, and weighing 28 tons. It was, after much difficulty, sunk, when machinery was erected to pump out the water; it was then found, that 12 feet below the sur-

* *Mechanics' Magazine*, 13th July, 1844.

* *Mechanics' Magazine*, vol. xlix, pages 33—35. A part of Sir Samuel's iron cylinder is still lying at Sheerness.

† The newspaper part of the *Gardeners' Chronicle*, 24th February, 1849.

face of the mud, the solid rock existed. This was lately excavated to the depth of three feet below its surface, when a solid mass of rock, capable of sustaining any weight of masonry which could be based upon it, was found."

It seems, from the above description, that Mr. Brunel's cylinder is answering the double purpose devised by Sir Samuel, of examining the ground and of constructing within it the piers of the bridge, in the manner of his moveable dams, patented 5th March, 1812. It was to obviate the difficulty of placing an iron cylinder, that he devised the wooden one, which was so easily managed in Portsmouth Harbour, as appears in the above mentioned article in the *Mechanics' Magazine*, pages 34 and 35. That wooden cylinder, as indicated in his letter to the Navy Board, 1st February, 1812, was about four feet in diameter, and, besides being more easily manageable than an iron one, was far less costly. The expense of it was estimated at between forty and fifty pounds.

In a letter, dated Portsmouth, 2nd February, 1812, to his friend, General Twiss, Sir Samuel, after speaking of his mode of laying foundations in bad ground,* said, he "had lately been led to contrive means of carrying on foundations under water in good ground; that is, where the ground is water tight, such as the blue clay at this place." "The means that have occurred to me appear greatly preferable to the expensive mode of coffer-dam piling usual in such cases." "According to this mode, I should produce the same effect as is now produced by forming a dam by piles. I should press down a complete wall, as it may be called, of wood, the lower edge of which being sharpened and protected with iron, or being formed altogether of iron, say a foot or more in depth, but easily detachable at pleasure; this wall, so shod, would easily enter the ground, the whole together thus forming a dam, under cover of which any work might be executed. When the case should be taken up, the iron shoe might either be drawn out with it or be left in the ground, if requisite, for the permanent protection of the footing of the work.

"According to this principle, I should first dig away the loose mud or shingle, and level the surface of the ground supposed to be water-tight by one of my digging engines, and should proceed to examine the ground. For this purpose, being provided with one of the abovementioned cylinders, when the edge had cut into the ground, I should begin to pump out the water, when, if the water should be found still to pass under the bottom edge, it should be pressed in deeper, until the passage of the water was prevented." "Other parts of the ground to be built upon, should be so examined successively, and the mode of proceeding be determined on in consequence of the data so obtained."

"For the ready pressing down such a cylinder into the ground, and for raising it afterwards out of it, a false bottom may be prepared, to be inserted at pleasure in such manner as to retain the water to the height of high water, so as to afford a sufficient pressure when the tide ebbs away from the outside, to press it into the ground; or for raising the cylinder, by preventing the water from entering it when it is desired to be taken up again; then, at high water, by letting it under the false bottom, the pressure of the water upwards against it, would raise the cylinder out of the ground. It was in this manner, but by means of an iron instead of a wooden cylinder, that I examined part of the ground at Sheerness; and, from the experiments there, I feel satisfied of the efficacy of this mode of damming under water; and, from calculation, it appears that a dam so formed would be very considerably cheaper than any dam according to the usual modes, as only short portions of it would be required at one time, which might be moved successively from one part of the work to another, with very little labour; and the junctures might easily be made water-tight in various ways.

"What I have to beg of you, my dear Sir, is, that you will tell me if you know of any instance of such a mode having been already practised; for, although I do not myself know of any, you, in your more extensive experience, may have seen instances, and I should feel myself much obliged by any information you may afford me on the subject."

So anxious was Sir Samuel never to take the credit to himself of any invention which had been before practised

* *Mechanics' Magazine*, vol. xlix., page 278.

by others. General Twiss, in his reply, considered the mode in question as quite unprecedented.

The success with which Mr. Brunel has used the cylinder, may induce other engineers to adopt this and other parts of Sir Samuel's inventions for examining ground and forming dams; if so, reference for further details will, doubtless, be made to the patent itself, 5th March, 1812.

M. S. B.

SMOKE RESPIRATORS.—ROBERTS' HOOD AND MOUTH-PIECE.

Sir,—I read with some little surprise the account given in your last Number (p. 305), of some experiments recently made with a *smoke respirator*, said to be invented by Messrs. Robinson and Siems, about which they affect much mystery—"the means being for the present kept secret."

Justice to departed worth requires it should be stated that the *smoke respirator* was invented, five-and-twenty years ago, by John Roberts, a miner, and publicly exhibited by him at Bolton, Manchester, London, and other places. The apparatus consisted of a *hood* or mask, to which was attached a *respirator*, consisting of a tin funnel filled with moistened sponge. In order to take advantage of the stratum of fresh air (which, in case of fire, is always found near the floor), the *respirator* was connected with the mask by a distended flexible tube. The principle of its operation is as follows: the gaseous and other noxious matters which exist in a burning building, are, by the art of inspiration, obliged to pass through the *respirator*, where they are absorbed and neutralized by the liquid contained in the sponge, and the air enters the lungs in a comparatively harmless state.

A slight attention to the nature of chemical absorption will always direct the operator to the most suitable liquid wherewith to moisten the sponge. In ordinary cases of fire, the smoke abounds with sulphurous acid, carburetted hydrogen, and carbonic acid, which jointly may be absorbed by water; as also sulphuric and muriatic acid. Carbonic acid, nitric acid, &c., may be effectually absorbed by the addition of an alkali to the water. In all ordinary cases of fire, however, *water has been found fully adequate for the purpose*. The complete efficacy of Roberts' apparatus was repeatedly demonstrated in the presence of numerous scientific individuals, the inventor remaining for a long time in close apartments, filled with the most noxious smoke that could be generated by burning wet hay and straw, shavings, coals, sulphur, resin, &c. The invention received the approbation of the most distinguished chemists and men of science in the kingdom; the Society of Arts testified their sense of its value by a reward of fifty guineas and a medal; the Manchester Guardian Office presented the inventor with a similar sum, and his Majesty George IV. gave him 100 guineas.

The *apparatus* of Roberts, never came into general use, but the valueable principle he established, viz., *the effectual purification of air vitiated by smoke by filtration through a moistened fabric* has ever since been successfully acted upon whenever required. Thus, for instance, in "Directions for aiding or effecting escape from fire," issued by the Royal Society for the Protection of Life from Fire, it is said, "If there is much smoke, a *wet handkerchief* will be found useful, inasmuch as when tied over the face it permits free breathing, and excludes the smoke from the lungs." Accordingly, the Society's conductors have resorted to this expedient whenever they have found the smoke inconvenient.

At the fire in Tennis-court, Holborn, in December last (as narrated at page 251), where the premises were filled with a suffocating smoke from damp and dirty shavings, Conductor Christianson *wetted a woollen comforter* which he wore, and placed it over his mouth; thus protected, he passed without inconvenience through the smoke, and rescued three persons in an incipient state of suffocation. For the principle and practice of *smoke respirators*, therefore, up to the close of 1848, we are indebted to the late John Roberts; whether anything *better* is forthcoming in 1849, remains to be proved.

With respect to the "NEW *smoke respirator*" announced at page 305, I have many doubts. Conductor Christianson's successful application of the *wet comforter* was a subject of conversation in the

presence of Siems, who would seem to have adopted the principle; in order to connect himself with the Royal Society for the Protection of Life from Fire, he and Siems made Conductor Robinson (who never perpetrated an invention in his life) a partner in the affair, which was thus jointly brought under the notice of a few persons connected with the Society. The inventors object to disclose their "secret" on account of its *simplicity*. More *simple* than the discovery of Roberts, or its rough and ready application by Conductor Christianson, it can hardly be! To suppose that A. M. Perkins, Esq., or J. R. Taylor, Esq., are not to be trusted with the inventor's "secret," is ridiculous, and leads us strongly to suspect there is no "secret" in the matter. The distrust of these gentlemen is too bad, giving, as the latter did, the use of his premises for the experiment, and inducing his colleagues to stultify themselves by "resolving" to purchase "a pig in a poke." In a prospectus issued by the Society, it is stated that "the meeting having (*had*) been specially convened for the *investigation* of the invention," &c. Now to me it looks like an Irish *investigation*, when the invention to be *investigated* is neither *shown* nor *explained!* The *results* only were shown, and these might—*for they could*—have been produced by Roberts' simple plan of a moistened sponge, or other suitable fabric. Neither of the Society's inspectors, nor any practical fireman, was present at (or invited to) these experiments. It has been said that

> "The pleasure is as great
> Of being cheated as to cheat."

Doubtless it is so, or the Society would have availed themselves of the means within their reach of correct information on this subject, so as to guard against the practice of any deception by artful and designing men, or against being misled by the enthusiasm of sanguine, but ignorant inventors of what may possibly turn out to have been long previously *publicly known and used!*

A *smoke respirator* for *lamps* is a desideratum, it being found that lamps are constantly extinguished in smoke which can be entered by human beings without much inconvenience. Can Messrs. Robinson and Siems supply this deficiency?

I am, Sir, yours, &c.,
WM. BADDELEY.

29, Alfred-street, Islington, Feb. 21, 1849.

SMEATON.—THE OAK.—AND THE EDDYSTONE.

Sir,—We are accustomed to see very frequent reference made by writers and speakers to the alleged fact of Smeaton having taken his idea of the figure he adopted for the Eddystone Lighthouse from the trunk of the oak; and it was, it is said, to his strictly conforming in this particular to an actual representation of nature, that the success of his celebrated work was mainly, if not altogether owing. Whatever may have been the idea Smeaton entertained upon the subject, there can be little doubt of its being highly valuable; but it is utterly impossible that he could have entertained the endless variety of interpretations now-a-days put upon the analogy (if any) which he believed to exist between the trunk of the oak and that of the structure which stands as a monument of his exalted genius.

Thus we find one writer, in treating of sea walls and marine barriers, refers to the majestic oak as the *emblem of strength* "which it is well known Smeaton copied in building the Eddystone;" whilst another writer, or perhaps the same, refers to the willow as an *emblem of weakness* to establish precisely the same position. Again; one writer will refer to the circumstance of Smeaton having copied the oak, for the purpose of proving the superiority of a *vertical* sea wall over all other forms; another will cite the same circumstance to show that the absolute necessity of a *slope* is by it made very apparent indeed.

For my own part, looking to the exact nature of the forces which a growing tree has to sustain (and I can see no peculiarity in the oak, as compared with many other trees of the forest), and comparing them with those to which the Eddystone Lighthouse is subject, I confess my inability to perceive the excessive force which has been so frequently attributed to the illustration.

Might I, therefore, beg that some of your able correspondents will place Smeaton's idea on the subject of the "oak" in its proper light, through the medium of your columns, the exact mechanical principles involved, and the analogy which exists between the forces to which a growing tree is exposed, and those which lash the trunk of the Eddystone Lighthouse.

I am, Sir, yours, &c.,
W. S.

March 10, 1849.

MR. NEWALL'S PATENT IMPROVEMENTS IN LOCKS, SPRINGS AND RIGGING.

(SEE ANTE, P. 306).

The Specification.

First, my improvements in locks consist of the following arrangements: Figs. 1 and 2 represent plans of the works of the lock in different positions with the bolt left out, figs. 5 and 6 show the bolt in corresponding positions.

I prepare two metal rings, *a* and *b*, of the shapes shown in plan, fig. 1, and section, figs. 3 and 4. The one ring, *a*, which I call the key ring, being accurately fitted and ground into the other, I then bore in these rings two holes exactly of the same size, and exactly opposite to each other, leaving a shoulder in the inner, or key ring, against which the key bolts are pressed by a vulcanized India rubber, or other suitable spring, *e*; these key bolts are made of steel, each in two pieces, and are accurately fitted to slide in the holes bored in the rings *a* and *b*; the thick part of them, d, d^1, being longer than the length between the shoulder of the hole in the key ring, and the outer circumference of the ring, *b*, and the thin part, d^2, projecting into the key-hole, to be acted upon by the key as hereafter described; the key is formed, as shown in figs. 3 and 4; two grooves, *f*, are cut on opposite sides of it, as shown in cross section, fig. 3^a, by a rotary cutter, or other means; the grooves are large enough to admit the small ends, d^2, of the key bolts to slide along them, and are formed with irregular or wavy bottoms, which differ from each other, the greatest depths of the grooves being at the end of the key, so that when the key is inserted into the key-hole up to its shoulder, *g*, as in fig. 4, the key bolts shall be pressed outwards from the centre, and the thick ends of the inner pieces, d', of the key bolts are then made to coincide exactly with the circumference of the key ring. In this position the outer pieces of the key bolts can offer no opposition to the key ring, *a*, being turned round by means of the key; but when the key is withdrawn, the spring acting upon the outer pieces, *d*, presses the inner pieces against the shoulder. A "feather" on the key fits into the slot, *h*, of the key ring to take the strain off the ends of the key bolts when the key ring is being turned round, and a pin, *i*, projecting from the key ring moves the bolt of the lock. The ring, *b*, is fixed to the box, or case of the lock. In fig. 5, the bolt is shown as thrown full out; and in figs. 2 and 6, the key ring has made a quarter of a turn. When the key ring has made half a turn, the ends of the key bolts come exactly opposite to each other, and if the key be withdrawn from its hole the spring will pres the key bolts against their shoulders in the holes, and thrust the outer pieces, *d*, into the key ring, *a*, so that the key ring cannot be turned round except by means of a key which shall press out the key bolts to the proper distance at the same time. The number of key bolts may be increased. If three be used, they must be at equal distances from each other, and a third of a turn of the key ring will lock or unlock them. If four bolts be used they may be placed exactly at right angles, and then a quarter of a turn will lock or unlock them: or if two of them be placed opposite to each other, as in fig. 1, then the other two may be placed opposite to each other at any convenient angle with the other two, and then the key ring must make half a turn to lock or unlock; if five or six bolts be used they must be placed at equal distances from each other, and supposing that a pin projecting from the key ring be used to move the lock bolt, then any number of fifth or sixth parts of a turn (together not exceeding half a turn) will lock or unlock; but if other means be used to move the lock bolt, then it may be so arranged that any number of turns of the key will lock or unlock. The key bolts may be arranged in sets one above the other.

Second. My improvements in springs apply to those made partly of vulcanized India-rubber. I take two plates of iron, and form them into the shape represented by *a*, fig. 7; the inner edges are bevelled, as shown in section, fig. 8; the two plates form a box, into which I place square blocks of vulcanized rubber, separated by thin plates of iron, as shown in fig. 7: projecting pins in the thin plates keep the rubber in its place: there is a space between the side of the box and the rubber, to allow of its expansion when compressed.

Fig. 9 shows the application of these springs to ships' rigging. *b*, being a screw for the purpose of setting up the rigging; it passes through one end of the box, and presses against a pin of iron on the top piece of rubber. Fig. 10 shows another form of one part of the box, which may be fastened directly to the ship's side without channels, the other part being like fig. 7. I use a hempen laniard for fastening the shroud to the spring, so that if it be necessary to cut away the masts, the rigging may be separated from the spring by cutting this hempen laniard.

Third. Fig. 11 shows another means of fastening and setting up the rigging of ships. Hitherto, when screws have been used, the

Fig. 1.

Fig. 3.

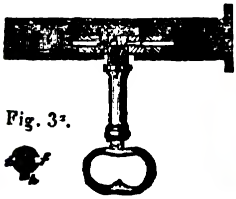


Fig. 3*.

Fig. 2.

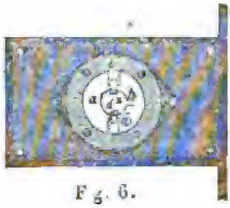


Fig. 5.

Fig. 4.

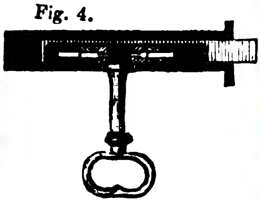


Fig. 6.

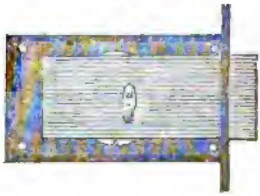


Fig. 7.

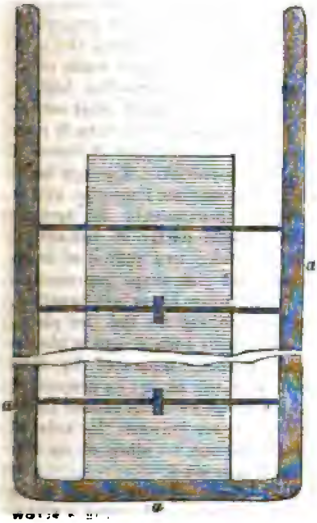


Fig. 8.

Fig. 9.

Fig. 10.

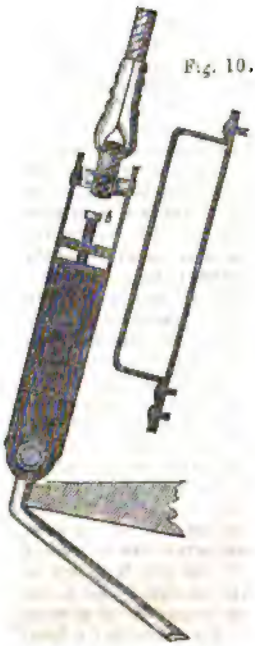


Fig. 11.

thread of the screw has been left exposed to the corroding action of salt water. My improvement consists in making the parts of the screw as shown in the engraving. The part, *a*, has a right-hand male screw, for a short length only; at the lower end it works into the female screw cut through the entire length of the part, *b*, which has also a short left-hand screw cut on its lower end, which works into a corresponding female screw cut in the part *c* as far as *d*; the part *b* has a nut formed on it at *e*, and by which it is turned round, and in this way the parts *a* and *c* are screwed together or separated.

CORK SAFETY RAFTS.

Captain Bullock, R.N., has addressed the following letter to the First Lord of the Admiralty:—

Woolwich, March 29.

Sir,—In laying before you the model of a raft which is intended to show how the means already furnished to every steam vessel may be applied to an object worthy of serious consideration—viz., the preservation of life from shipwreck—I make no claim to scientific invention, or, indeed, to any merit beyond that of realizing a conception which seems to promise to be made useful to the maritime world, and turning to account the never failing ingenuity of seamen in times of peril—nor need I affect to offer any other apology to the First Lord of the Admiralty in calling his attention to the subject, than the obvious utility of the design, and the extreme simplicity of its construction; and I only ask as a favour that should it be useful and deserving of your patronage, that it may be called "Captain Bullock's Safety Raft," trusting that sooner or later it may connect my name with the cause of humanity, towards the promotion of which your approbation would contribute most effectually by causing its adoption, not only in the Royal Navy, but also in every merchant steam-vessel in Great Britain. If the difficulty of constructing a raft under trying circumstances be generally admitted by experienced professional men, the great advantage of having such a means at hand and ready on the emergency will be apparent to every one; and the consequence of wanting such a means has been exemplified in numerous disasters in times past, as well as melancholy occurrences of recent date.

The contrivance of a simple raft for saving a ship's crew and transporting them to the shore through surfs and breakers that would inevitably swamp boats of every description, has long occupied my mind: but, last year, on observing the the fitting of the bridges in the Folkestone and Boulogne packets of the South-Eastern Railway Company, my thoughts on the subject assumed a definite form, and on my return from service I presented my model to Admiral Dundas, who most kindly entered into my views, and seeing there was no great expense attending the experiment permitted it to be fitted to Her Majesty's steamer, *Widgeon*, at Woolwich.

The raft is easily described; it is, in fact, the bridge (as the elevated and necessary communication between the paddle-boxes is called,) and is formed of four pieces of broad plank, strongly united at the corners, and made buoyant by the addition of cork conforming to the breadth of the frame, to which I had added a centre plank for the convenience of carrying a boat of the lightest description, which will afford a comparative security for the weak and disabled.

The bridge, instead of being a fixture as heretofore, is now entirely detached, and the planks being fastened together by swivel bolts allows it to adapt its form readily to the circumstances under which it may be required to be launched or floated out of its place, and, in case of fire, to be passed forward or aft, between the masts and rigging, and prepared for service at the part of the ship the most remote from the danger.

I may also affirm, from experience, that the raft would become a floating breakwater to the boats whenever the crew were compelled, from any distressing circumstance, to abandon their ship at sea, by mooring them to it under its lee; nor can the boat affixed to it, by any possibility, be capsized.

I have the honour to be, &c.,

FREDERICK BULLOCK, Captain, R.N.

The Right Hon. Sir F. T. Baring,
First Lord of the Admiralty."

If Sir F. T. Baring will refer back to the Admiralty Records during the administration of Lord Melville, he will find that a safety raft of precisely the same description, was proposed to Government by Mr. George Cumberland (an old and frequent correspondent of our own,) with the exception of its peculiar adaptation to steam vessels, which had not at that time found their way into the naval service—Mr. Cumberland's plan was not adopted, nor even the receipt of it acknowledged, but he published a full account of it in "Nicholson's Journal," for October 1810, p. 134, from which we make the following extract:—

"About six years past, a solitary inhabitant of a promontory projecting into the Severn Sea, called Weston Super Mare, I amused myself much among the rocks there, and spent many hours in studying the action and form of water when impelled in the figure of a wave; it being my opinion at that time, as it still is, that the forms water takes from motion are so determined, that even in sculpture they may be represented with correctness; and that nothing would better teach us the art of representing motion by fixed lines, than these images so often repeated with exactness. On these occasions I frequently observed extensive masses of the sea weed called tang on that coast, and which the farmers burn for manure, floating into the hollow coves below me, on the surface of the most tremendous waves; and forming, if I may so express myself, a green carpet, that, undulating on the broken wave, was never submerged, although continually varying its surface; and on which, as on a resting-place, birds frequently alighted, or sat to repose themselves, as if it were a verdant down.

"On a coast so remarkably dangerous, where no boat could land even in comparatively tranquil weather, these *safe rafts* were very interesting, and led naturally to the

thought, whether such a sort of raft might not be constructed of other materials, fit, instead of birds, to carry men. The result o which was, it appeared to me, that if each sailor in a man-of-war had a cork mattress, and these mattresses were all linked together by cords, such a float, capable of landing safely even on breakers, would be produced.

"Pleased with the thought I went to Bristol, and consulted a cork-cutter there as to the quantity of cork necessary to support a man; and soon found, that a very moderate weight would do, and that cork shavings were then worth only 8*d*. per bushel, and chiefly sold for firing, or to make guards for privateers to fill the nettings.

"It therefore struck me, that, as mattresses are necessary in the navy for the hammocks, and nothing dryer than cork or easier to shave into a thin elastic body, it might answer the above end, to fill these mattresses with this substance, in a proportion equal to the support of a single man: and then a mass of them thrown overboard, linked together by ties at each corner, where cords might be always attached, would form an extensive raft, capable of sustaining, out of the water, as many men as there were of these mattresses united; and thus conveying them on the tops of the waves, and depositing them safely on shore, or even on the surface of rocks, when the sea retired with the tide.

"To contemplate such a thought in imagination is truly delightful; but to believe, as I do, that the thing is practicable with ease, and not communicate it to others, is impossible. I have therefore done all in my power to extend the idea from my own bosom to the mind of the public at large, having first addressed my wishes and plan to that quarter, where the power of putting it extensively into execution alone exists.

"As your Journal must ultimately reach all countries, I therefore wish to deposit these reflections in it, in the hope, that they may thus be extended to some practicable benefit, if not to ourselves, to our neighbours, or some distant clime, where the coasts are equally dangerous: for all other rafts, that I have either seen or contemplated, have this great defect, that they come on shore with too much force, and that the blows they receive either disjoint them, or throw off the people; that their wrecks are more dangerous than the rocks they stand on; and that every time they pitch, those on them are covered, and some never may be able to retain their hold or rise again.

"I am, &c.

"G. CUMBERLAND.

"Bristol, 17th August, 1810."

Of Mr. Cumberland's prior claims we can very well suppose Captain Bullock to be entirely ignorant; and we dare say, that when now apprised of their existence, he will be as ready as any one to recognize them. Captain Bullock's plan, after all, is but a very imperfect revival of Mr. Cumberland's, for the former but proposes to make a cork raft of the bridge between the paddle-wheel cases of steamers, which might or might not be sufficient for the rescue of a ship's crew; whilst the latter proposes that every sailor on board of every ship (whether steamer or not) should have his cork mattress, so that by linking the mattresses of a whole crew together in cases of shipwreck, a raft might be at once formed, equal to the conveyance of all on board, in safety to the shore, with an ample store of provisions besides. The surest way for Captain Bullock to gratify his laudable ambition "to connect his name with the cause of humanity," would be to relinquish at once his own scheme—of very limited utility at best—and exert himself with all his might to promote the adoption of the larger and more efficient plans of Mr. Cumberland. To be the introducer into actual use of "Cumberland's Safety Rafts," (their true name) would be honour greater far, than any to be derived from being the author of a bad copy of a good original.

ON THE SUPPOSED ADVANTAGE OF AUXILIARY BALLOONS IN AERIAL NAVIGATION.

Sir, — There are doubtless many readers of the *Mechanics' Magazine*, who will remember that Mr. Gale, the aëronaut, who ascended from Cremorne Gardens last year, exhibited during the previous summer an invention for economising the power of the balloon, by preventing the loss of gas consequent on its expansion, when the balloon reaches an elevation where the air is less dense. A description of the invention appeared in the papers of that time, accompanied (if I am not mistaken) by some remarks characterising it as a valuable improvement; and so it certainly would have proved had it accomplished the *professed object* of the inventor; for although it would have added but little to the efficiency of the balloon, yet it would have

been one step forward in the progress of a science, which has been destined to make little or no progress since its first discovery; for, notwithstanding we have aëronauts who nearly every summer treat us to a practical exposition of the science of which they are the acknowledged professors, yet with the exception of a better knowledge of the upper currents of air, they have not made a single contribution of any importance to the small stock of knowledge we already possessed of the science of aërostation. The balloon itself remains at the present time nearly the same as it came from the hands of its original inventors; the only improvement that has been effected being merely in the details, such as a slight alteration in the shape and an improved construction of car and valve.

Pardon this digression, and return with me to Mr. Gale's invention of auxiliary balloons, which, in my opinion, instead of being, a step forward, is, in fact, a step backwards; for it will not add to, but materially impair the power of the balloon.

To explain clearly the fallacy of this invention, it will be necessary to state, for the benefit of those who may not be acquainted with it, that it consists in the addition of two smaller auxiliary balloons attached to, and communicating with the interior of the large or parent balloon, one on each side, in such manner that they can be elevated, by the means of cords, to a level with the top, or allowed to fall below the neck of the parent balloon. When the balloon starts from the earth, the two small balloons hang empty by the side of the larger one, but when the balloon attains an altitude where the air is less dense, and consequently the gas expands, thereby increasing its volume to such an extent, that the balloon is incapable of containing it, the aëronaut, instead of allowing the gas to escape, elevates the two auxiliary balloons to a level with the top of the parent balloon, when the ascending power of the gas causes it to rush into, and inflate them. By these means the parent balloon is for a time relieved of the surplus gas; but should any further expansion take place, the gas must then escape into the air. When condensation takes place, the action of the auxiliary balloons is then reversed by lowering them a sufficient distance to allow the gas to ascend into the parent balloon. To a casual observer, the addition of auxiliary balloons might certainly appear an improvement, but on closer examination it will be seen that all that can be effected by the auxiliary balloons can be done much better without them, by partially inflating the single balloon, only leaving sufficient room for the gas to expand. Now, in reality, this is all that can be done by the auxiliary balloons; and as they are no less influenced by the attraction of gravitation than the parent balloon, the three balloons may be likened to one of larger diameter, the parent balloon representing the inflated and the auxiliary balloons the uninflated portion. The loss of gas, consequent on expansion, can no more be prevented by the use of the triple than the single balloon, while the use of the small balloons (in addition to their being a cumbrous appendage) destroys the symmetry of the balloon, and requires the attention of the aëronaut, and is also attended with a loss of power.

To show more clearly the disadvantage attending the use of auxiliary balloons, we will, by way of illustration, suppose a case in which the parent balloon is twenty feet and the auxiliaries ten feet in diameter. The parent balloon would then hold 4188 cubic feet of gas, and the two auxiliaries 1047, or one-fourth of the contents of the parent balloon. The parent balloon being inflated to the full extent of its capacity, the gas could expand one fourth of its original volume without loss; but if, instead of using the three, we use only one balloon of 22 feet diameter, we shall find that by inflating it with the same quantity of gas as the parent balloon of 20 feet diameter will hold, there will be a greater space left for expansion than will be afforded by the two auxiliary balloons of 10 feet diameter, while the quantity of silk used in the construction of one of 22 feet will be much less than that required for one of 20 feet and two of 10 feet diameter. A balloon of 22 feet diameter will contain 5575 cubic feet of gas; therefore if inflated with 4188 feet of gas, there will be 5575 (4188 x 1387) feet left for expansion, instead of 1047 feet. The silk required for the construction of the triple balloons will be 1884 square feet, and for the single balloon 1530 feet, there being a saving in

favour of the single balloon of 354 (1884−1580) square feet of silk, with the advantage of holding 340 cubic feet more gas than the triple balloon. Trusting that I have shown sufficiently clear the disadvantage attending the use of auxiliary balloons,

I am, Sir, yours, &c.,
HENRY BARNES.

83, Newman-street, Oxford-street.

WORKING SHIPS BY MANUAL POWER.

Sir,—In reference to the desire expressed by "M. S. B" (in the *Mechanics' Magazine* of 24th March), to know how the manual power of ships' crews might be best applied to the propulsion of ships, I beg to offer a few suggestions. The most simple and economical mode appears to me to be the following, if used in vessels already fitted with steam power, and working either with paddle-wheels or with the screw (the latter, especially). First, there should be a facility of unconnecting the paddle-shaft or screw gear (as the case may be) from the engine. Next, a toothed or band-wheel should be fitted to the spindle of the capstan, and of any convenient dimensions. Such wheel might be fitted so as to work close under any of the deck beams, and so as to be united or separated from the capstan at pleasure, by means of a clutch, similar to that adopted for uniting and separating the parts of the patent capstan now in use, and fitted in a similar way, by proper gearing united to or separated from the paddle-shaft or screw gearing. The capstan bars would be shipped in the usual way for getting up the anchor or warping the ship, and the men heaving thereat in half watches, or as the commanding-officer should otherwise see fit, would easily obtain a speed of 5 knots an hour. By this method, it will be at once perceived that a very trifling expense would suffice, as the whole of the gearing required would be only one large and three smaller toothed wheels, a length of shafting, and the necessary bearings, all of which may be fitted to the underside of any of the deck beams where most convenient, and would occupy very little space when fixed.

I am, Sir, yours, &c.,
S. S.

Bowling Green-lane, Southwark,
March 30, 1849.

PRINCIPLES OF RAILWAY RATING.

Sir,—In your publication, No. 1317, I find an article on the elements of railway rating by Mr. J. W. Woollgar, in which he shows in a very brief form how to arrive at the present system of railway rating. At the outset, however, he makes an assertion which is rather startling, namely, that "A railway ought to be assessed at the same amount collectively as if the whole of it lay in one parish, whether the earnings be uniform or otherwise." As this is a subject which has for some time engrossed my attention, and the conclusions at which I have arrived are rather different from those of Mr. Woollgar, I beg to lay them before you, so that if in your judgment they are important, they may be placed in the columns of your useful publication.

1. *As to how a railway ought to be assessed.*

Mr. Woollgar places the gross receipts of one year in one column, which for conciseness I will call a debtor column, and gives credit in another, which may be called the creditor column, for the gross rental of stations and buildings, working expenses, ordinary repairs, servants' wages, Government duty, local rates, taxes, tithe rent-charges, per centage on the capital necessary to carry on the traffic, and an allowance for landlords' rent, renewal, repairs, and insurance. He deducts the amount of the one column from that of the other, and calls that the nett rateable value of the railway. Now, this amounts to neither more nor less than saying that the assessable property of a railway is the nett annual profits; which I conceive to be a very unfair and partial way of putting the case, and so far as the shareholders are concerned, an unjust one. In this and the neighbouring parishes, the parochial assessments upon all dwelling-houses, warehouses, mills, and works of every description with power used therein, whether steam or water, and all premises used in manufacturing and other purposes, are fixed upon the gross annual valuation, or annual rent, from which a deduction is made for landlord's rent, renewal, repairs, and insurance; and the result produced is the rateable value. Such, then, being the principle upon which all occupiers of dwelling-houses, warehouses, cotton and other mills, bleach works and others, are rated, why

should any other method be adopted in assessing railway property? Neither the amount of the material produced in any of the abovenamed manufactories, nor yet their value, was ever, that I am aware of, taken into consideration in order to obtain their rateable value: and as little ought the amount of traffic, or receipts of a railway, to be introduced to obtain its parochial assessment. The following method would, I think, meet the objections I have raised to the present system, and, so far as the shareholders or parishioners are concerned, be a just and equitable one:—

{ Gross annual value or amount expended on stations, warehouses, bridges, viaducts, tunnels, embankments, cuttings and fillings, rails, machines, &c. } + Per centage on locomotive steam power. − { Wear and tear and insurance. } = { Nett rateable value. }

2. *As to whether a railway ought to be assessed collectively or otherwise.*

According to the present legal system as laid down by Mr. Woollgar, the whole of the profits upon a line are according to the length of the line divided equally, making an average mileage proportion, which is considered to be the average mileage assessment; and all overseers of parishes, through which the line of railway runs, ought to calculate the rateable value according to the length of the parish, taking the average mileage proportion as their data. Now, this I conceive to be a decided encroachment of one parish upon the interests of another, so much so, as to materially lessen the amount of the rateable value of railway property in parishes where a railway terminates or has its station; for the extra amount expended upon any given mile which includes a terminus or station, generally exceeds that on any other half-dozen miles on the line. If the first and most expensive mile only pays the same proportion as any of the others, it follows that the difference must fall upon the parishioners at the terminus, who pay for the full assessable value of the premises occupied by them, while the railway company are only paying part of their assessable value, having to average the other portions with the least expensive portions of the line in the adjoining parishes. Property in one parish is assessed and rated for that parish only, no matter what connection it may have with property in another parish. For instance, if the boundary of two parishes, A and B, run through the works of a cotton manufactory, the mills and steam-engine being in parish A, and the warehouses for packing, &c., in B, the assessment of property in parish A would not be the average value of that in A and B, but of that in A alone. Again, if the residence of a gentleman be erected upon land at the junction of three parishes, A, B, and C, the dwelling-house being in parish A, stable and shippon in parish B, and other outbuildings in parish C; then the rateable value of the dwelling-house in parish A would not be the average rateable value of property in A, B, and C, but upon the valuation of the dwelling-house in A alone; each being valued separately and assessed according to the amount of money expended in their respective parishes. And this is almost invariably the way in which building and other property is at present assessed.

I cannot concur with Mr. Woollgar in the propriety of adopting any exceptional method of assessing railway property. I think all property should be assessable to its own parish, and assessed according to a valuation upon the amount laid out in that parish, irrespective of traffic or receipts, and no matter whether it belongs to a company or a private individual.

I am, Sir, yours, &c.,

JAMES LOMAX.

Bolton Le Moors, Lancashire,
March 20, 1849.

MR. TATE'S DIFFERENTIAL AND INTEGRAL CALCULUS.

Sir,—I was induced, by your notice of Mr. Tate's Treatise on the Differential and Integral Calculus, to procure a copy. I make no doubt that I shall be vastly benefited by the study of it; but, I fear me, hardly in the sense in which the author himself dedicates it to the public service (a point, by the way, on which you, Mr. Edi-

tor, observe rather a suspicious silence.) "The great physical laws," says Mr. Tate, in his preface, "by which it has pleased the Almighty to govern the universe, must always form a lofty subject of contemplation to his intelligent creatures; *but these laws can only be duly appreciated* BY THE AID OF THE SYMBOLIC LANGUAGE OF THE HIGHER ANALYSIS." So!! Fluxions the best helps to piety! The works of God to be only duly understood by the aid of a symbolic jargon, of the poor, though "intelligent creature," man's own invention!

Ah, well—if such be the case—we may see herein displayed the reason (never, I ween, suspected before) why Cambridge scholars make so much better divines than Oxford. It comes all of the greater attention paid on the banks of the Cam to the mysteries (by some, profanely called trickeries) of + and —. And herein, too, we may see, in any case, a striking (*query*, sad?) instance of the extreme depths to which men of even the highest intellect will sometimes descend, in order to humour, for the sake of some fancied personal advantage, the prevailing cant or folly of the day.

I am, Sir, your Constant Reader,

SIMPLICIUS.

P. S.—Do you think that when I have gone through Tate I might venture, with any chance of success, on the publication of a work, which I have much at heart, to be called the *Evangelical Euclid?* And would the Council of Education be likely to take it as (I am told) they do Tate's books, under their patronage?

[We passed over in "silence" the passage in Mr. Tate's book which has called forth this just rebuke, as one passes every day over many things "uncensured though not approved." Mr. Tate, however, is by no means the only offender on this score,—indeed, he is but the type of a rather numerous class. Mr. Hall has a passage in the Preface to his Algebra of which Mr. Tate's is but a free copy; and Hall, again, only borrowed his piety out of place from Sedgwick. Nothing, assuredly, can well be more absurd than to contend that our only possible means of understanding the laws of nature are furnished by symbols of our own making—symbols which can themselves have no meaning at the end of the most elaborate series, which we do not ourselves impress on them at the beginning. The mathematician who looks (or *affects* to look, a worse case by far,) up through a parcel of arbitrary signs, of his own invention, to "Nature's God," is precisely in the same case with the poor heathen who bows down to the graven images of his own handiwork—idolators both!—ED. M. M.]

WRONGFULLY USING REGISTRATION MARKS.

Justice Room, Guildhall.—April 4, 1849.

Before Mr. Alderman Gibbs.

Grant v. Welch, Margetson, and Co.

Messrs. Welch, Margetson, and Co., manufacturers of various articles of haberdashery which had been registered under the Copyright Act, were summoned before Alderman Gibbs, to answer the complaint of Alexander Grant, another wholesale haberdasher, of Clement's-court, Wood-street, for selling, on the 19th of March, two cravats, two stocks, and two ties, each of which had a label affixed purporting that the design of them had been duly registered on the 19th of May, 1847, numbered 1072, whereas, the design of none of them had been so duly registered.

Mr. Clarkson, with Messrs. Robertson and Co., agents for the registration of designs, &c., attended for the complainant; and Mr. James, with Mr. Reed, the solicitor, for the defendants.

Mr. Clarkson said this was an information under the 6th and 7th of Vic., sec. 4, the object of which was to prevent any persons from wrongfully affixing the copyright marks, after the copyright had expired, or to advertise it as a registered article, or to sell it when so marked. It also prevented any article from being described as registered which had not been registered at all. The complaint in this instance was, that Messrs. Welch and Margetson, having registered a peculiar description of stock, had afterwards issued another description of stock, with the identical mark which properly belonged to the first; and having done that, the defendants sent notice to Mr. Grant and to several of his customers, to desist from making and selling his stock, describing it as a piracy of the copyright design 1072. He should produce the specification of 1072 to show the total dissimilarity of the article manufactured by Mr. Grant. Messrs. Welch's stock was called the "aerial stock," and the novelty claimed consisted in the stiffener being of one-half the usual depth, so that there was only one thickness of satin in front of the throat, and the wearer had all the coolness and ease which must result from such an arrangement in the summer time. Mr. Grant sent out another description of summer stock, which consisted of the satin bands without *any stiffener* inside, and so arranged that the bow should conceal the fastening, which was under the tie in front. Upon this Messrs. Welch and Margetson sent out a new article resembling Mr. Grant's, but labeled as the registered article, which it was quite unlike, and to the detriment of his client's business. He thought Mr. James would admit he had truly described the case if he wore one of his client's "aerial stocks."

Mr. James said he was content to wear the terrestrial one. The question was the construction of a specification. The specification set out that the novelty of design secured greater ease and coolness to the wearer, and it might be worn with or without the stiffener. It spoke of the ends being sewed up, which rendered the stiffener permanent, or that the ends might be secured with buttons only, so that it might be removed if requisite.

Mr. Alderman Gibbs, on looking at the specification, said it did not go to that extent. It did not say the stiffener was removed at pleasure, or that the stock might be worn with or without it.

Mr. James said it was surely to be implied that the stiffener was removable, when it was stated that the ends of the stock might be sewed.

Alderman Gibbs observed that the drawings in the specification did not present a stock without a stiffener. The whole point of the specification was the peculiar shape of this stiffener, which presented a single instead of a double thickness in front of the neck. The article now complained of, which had no stiffener at all, could not be deemed the same design.

Mr. James objected that the article complained of did not bear a mark of registration, for it was marked "Regd." by Welch, Margetson, and Co., while the 4th section of the Act of 6th and 7th Vic., required that the word "registered" should be at length.

Alderman Gibbs asked how that was on the genuine article, 1072?

Mr. James said that was immaterial. If they had lost the benefit of registration by any neglect in this respect, that was another matter.

Alderman Gibbs said he had no hesitation in deciding that the complaint was proved in this case, and he should adjudge the defendants to pay a penalty and costs.

Mr. Clarkson hoped the alderman would allow the case to stand over for a week, as it was a pity for two respectable houses to be going to law, and incurring great expense. He therefore proposed, with the view of coming to some amicable arrangement, that the defendants should withdraw the letters that had been sent to the trade, interdicting the sale of his client's stocks.

Mr. James assented to the postponement, for the purpose of coming to an arrangement, and so the matter ended.

THE BAGNALL FAMILY.

The late Mr. John Bagnall, sen., was originally a persevering, industrious, working collier—dependent for the support of himself and family upon the earnings obtained from such a source. Endowed by nature with good qualifications, and possessing a marked determination of character, he was soon enabled to resign his post of "operative miner" for one of a more important nature—viz., that of mineral surveyor; in which capacity he highly distinguished himself. By the exercise of steady perseverance, foresight, and economy, he was enabled shortly after this, in conjunction with a brother, who still survives him, to enter into business. A colliery was taken on royalty, which then offered itself—the management of which devolved more immediately upon himself. Here it was more especially that he felt the value of his *practical mining* knowledge. The management was conducted upon principles of the utmost economy; and the result was, accordingly, beneficial in proportion. Surrounded, as might be expected, with a varied class of individuals, whose conduct was marked, probably, with unenviable excesses, and with part of whom he would occasionally be brought in contact, it might be supposed that temptations on their part were neither few nor feeble. His firmness and decision enabled him to meet such with bold repulses; his mode of procedure, was, therefore, unaltered. He had an object in view, for the accomplishment of which he was steadily progressing. He was ever found at his post in punctual discharge of business demands. As a recompense of diligence and attention, associated with good natural talents, his judgment became matured; his mind, which was always sober and thoughtful, became enlarged; and his opinion in cases of "mining difficulty," was eagerly sought, and highly esteemed. We here see his mind raised to such a position in the world as to command respect of his superiors—a position, moreover, rendered more valuable by his upward movements from the greatest obscurity. In the progress of time he had accumulated a sufficient capital to induce him to extend his operations. Accordingly, he embarked in the iron trade; here, too, he acted with his usual degree of caution. His doings in this department were at first small and feeble; he, however, gradually improved his position, till, with the assistance of his sons (some of whom had now grown up, and begun to take an active part in business), he was enabled to make very considerable additions—so much so that, at the period of his death, very few manufacturers, and similar in extent, occupied a better position. It cannot be wondered that his sons, having such a valuable tutor, should make equal progress with their late father. They were now well established, and highly systematic in all their operations. Each appears to have caught the father's particular qualification for industry, and they continued to labour as they had done in their father's day, apparently taking for their motto, "onward." Few individuals, I presume, in the present day have given a closer attention to their business, or exhibited more industrious habits, than the *present* firm of "John Bagnall and Sons;" and what is the result of all this? From the humble occupation of their father, as a *working* collier, events have so progressed, that now we may justly place them in the *first* rank of iron manufacturers. Their establishment, taken as a whole, is exceedingly large. Their mineral property has increased to an astonishing extent—so much so that, in the immediate vicinity of such operations, you can scarcely step without treading upon their property, and they are still augmenting it. The tide of prosperity is with them "ever flowing. So effectually have they conducted their operations, that *no* commercial depression, however severe it may be, can affect them. An idea of their great wealth may be gathered from the fact that, years ago, a certain banker pronounced the firm to be worth from 500,000*l.* to 600,000*l.* Since that opinion was given, we have had a good trade of some continuance—so that, if we take a moderate average of their annual profits, we may now consider them to be worth, probably, little less than 1,000,000*l.* sterling.—*Correspondent of the Mining Journal.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING WEDNESDAY, APRIL 4.*

ROBERT THOMAS PATTISON, printer, Glasgow. *For an improved preparation, or material for fixing paint, or pigment colours, on cotton, linen, woollen, silk, and other woven fabrics.* Patent dated November 2, 1848.

This improved preparation, which the patentee denominates "lactarine," is obtained, firstly, from butter-milk, by heating it in a boiler to 160° Fah., to separate the curd from the whey. The curd is placed in a cheese-press, and subjected to pressure for a time sufficiently long to express the whey. After this it is reduced to a granulated state and placed in wooden trays, having a bottom of linen or other fabric, to allow of its being exposed to the drying influence of a current of heated air. Lastly, it is ground to powder between a pair of edge stones in the ordinary way, and is then ready for use. Or, secondly, it may be obtained from skimmed or sweet milk by heating in a boiler, and precipitating the curd by means of oxalic or other acid, and preparing as in the first case.

The mode of applying this material, and the proportions to be observed will have to be varied according to circumstances. The patentee gives, however, the following example, which he states will be sufficient to guide a person in the use of it; 8 lbs. of the prepared curd are dissolved in 2 gallons of water, containing 4 gills of "ammonia fort," and thereby reduced to a gummy state; 12 lbs. of ultramarine dissolved in 1 gallon of water, are then mixed with it, when it is ready for use.

Claim.—Any preparation or material made or extracted from milk, by which paint or pigment colour combined and used in combination therewith can be fixed on woven fabrics.

[In what respect does this "lactarine" differ from the "*caseum*" of the ancients, so well known among painters? The process for making it given by Theophilus, as translated by Mèrimée, is nearly identical with that of the present patentee. "Take," he says, "some fresh cheese made with rich creamy milk, triturate and wash it with warm water, until all the soluble part is carried off by the water; this may be operated in a sieve or linen cloth, through which the cheese is afterwards pressed to get rid of the water; when quite drained it crumbles like stale bread; it is then dried upon unsized paper."]

* Being obliged, in consequence of the occurrence of Good Friday, to publish a day earlier than usual this week, the Specifications enrolled after Wednesday are necessarily deferred till our next.

DAVIES'S ROTARY ENGINE.

Sir,—In the last sentence of the first paragraph of my letter which appeared in *Mech. Mag.* of 31st ult., is a mistake of the press, which totally reverses the sense of the passage, and is directly at variance with what I had advanced in the preceding sentence. I had stated that it was desirable the action of the steam upon the piston should be maintained, through as great a portion of the revolution of the piston as possible; and I then went on to observe, that by the arrangement described by Mr. Dredge, the friction was rendered less than I had before supposed; but the period during which the piston is "inoperative," was thereby greatly extended. The printer has substituted the words "*in operation*," whereby my meaning is reversed, and I am made to impute to the engine, as an imperfection, a property which it does not possess, and which I had pointed out in the preceding sentence as desirable. Have the goodness to rectify the error in your next Number. Respectfully yours, A. Z.

NOTES AND NOTICES.

New Theory of the form of the Earth.—At the December meeting of the (Astronomical) Society, after the business was concluded, the Secretary, with a confidential air, addressed the Fellows thus: "Now, gentlemen, if you will promise not to tell the Council, I will read something for your amusement." He then read—amid roars of laughter—a letter in which somebody professed to have found out with a telescope that the earth is flat, not round. About a month afterwards the good town of Trowbridge was honoured by a visit from the discoverer, or one of his disciples, who placarded lectures to prove that the earth is flat. But the placard went on thus:—"N.B. A paper on the above subject was read *before the Council and Members of the Royal Astronomical Society, Somerset House, Strand, London*, (*Sir John F. W. Herschel, President*). on Friday, December 8, 1848."—So much for the *flatness* of the earth and of the inhabitants thereof.—*Athenæum.*—[The theory referred to was communicated to us by the author a long while ago, for insertion in our pages; but though we did not see fit to publish it, we saw too much honest purpose in the writer, to regard him otherwise than with respect. We suspect there were more who joined in the "roars of laughter" at the Astronomical than could have shown in good earnest where the fallacy of the writer lay. The seeing of the flatness "with a telescope" was but a fanciful paraphrase of the secretary's own; of the same order of wit as that displayed by Liston, the eminent surgeon, when he threw another class of like profound thinkers into convulsions, by remarking of a certain rustic clairvoyant that "his education was so far advanced that he could see with his belly." Men of real science—the very best of them—have been guilty of too many gross misjudgments—to be free to laugh at (almost) anything.]

What a Sneer can do.—I remember the late Richard Saumarez, Esq., showed me a barometer, in 1818, which he had constructed on the principle of the *elasticity* of the atmosphere—the resilience of the atmosphere being equivalent to the pressure arising from its gravity. I have never heard of another founded on this attribute. I esteemed Mr. Saumarez as a sincere friend—an acquaintanceship of not a few years. True, he was eccentric, haply, in some of his views, but his mind was sound and scientific, and he was both the gentleman and the scholar. Perhaps his feelings were too sensitive, for the sensibilities of his mind were acute; but this is a "weakness that leans to virtue's side." Poor Mr. Saumarez!—the last time I saw him was at the British Association, on the occasion of its anniversary, at Edinburgh, in 1834. He rose to read a paper on the subject of light, when, by a *preconcerted signal*, the chair and the platform were vacated—"strange, passing strange," treatment this. I do not pretend to account for the *mystery*, I only state the fact; perhaps the then *secretary* can

elucidate it. Mr. Saumarez returned to Bath, *only to die*, and his own physician confessed to me that he sunk under the rude shock. I think Mr. Saumarez supported the Newtonian view of the materialism of light, in opposition to the then prevalent undulatory hypothesis; so does Sir David Brewster; and a little novelty, even if eccentric in some of its phases, might well be excused in so abstruse a subject. Apart from his own personal virtues and scientific attainments, the brother of Lord Saumarez merited more courtesy and a different treatment. — *Professor Murray—Mining Journal.*

Optical Glass.—The following recipes by Mr. Cooper, glass manufacturer, Aberdeen, for making good optical flint glass, have been communicated to the Scottish Society of Arts:—

	lbs.
Sand, well washed, dried, and sifted	60
Oxide of lead	60
Purified carbonate of potash	15
Saltpetre	3·5
Cullet	15 to 20

The specific gravity of the glass is 3·568, and of ordinary density. A heavier glass is obtained by altering the proportions thus—

	lbs.
Sand	60
Oxide of lead	63
Purified carbonate of potash	14
Saltpetre	3·25
Cullet	20

The specific gravity of this glass is 3·628. In both cases the cullet must be of the same kind of glass.

New Saw-Filing and Setting Machine.—Messrs. Norton and Cottle, of Holme's Hole, have recently patented a machine for filing and setting saws, enabling the operator to whet and set the teeth of saws in such a manner, that every tooth will be equal in size and length, the proportion being graduated by an index, and so adjusted as to suit the teeth of saws of every description. Saws, that have been used and become useless in consequence of bad filing, can be re-cut, and made as valuable as new. The set is attached to the machine in such a manner, that when the filing is completed no alteration is required in the adjustment of the saw to complete the setting. The inventors have found by experience that the hardest saws can be set without breaking or injuring the teeth. Saws considered in a measure useless, having passed through this machine, are said to work perfectly easy, and to perform much faster than those filed in the usual manner; and the teeth being all of an equal length, will not require filing as frequently. These machines, if not too expensive, we think, will come into extensive use.—*New York Mechanic.*

Fast Printing. — Mr. Applegarth, referring to the statement that a Mr. Moseton has bequeathed a premium of £10,000, for the first machine that shall print 10,000 copies of a newspaper within an hour, makes the following gratifying announcement (*Times*, 4th April):—"In the construction of a machine to print more than 10,000 copies an hour, I propose to content myself with taking as a *datum* the *maximum* speed of the old flat machines, viz., 1,500 strokes, or 264,000 inches, per hour. This may be fairly laid down not as a *maximum*, but as a safe and practical driving speed. A machine similar to that at the *Times* office, with a (roto-vertical) type cylinder of 100 inches, and 10 printing cylinders arranged round it, driven at the above rate, would strike off 16,500 impressions in an hour. Now, the form of type and the inking table are about 80 inches in length, so that another form of the same size may be attached to the type cylinder, and with an upper story of laying-on tables added (as in use on the old machines), and a very little alteration to make each feeding apparatus do double duty, twice as many impressions may be made at the same time, that is, 16,500 sheets printed on *both* sides on one machine. In the course of last summer I had a correspondence with an eminent French printer on this subject, and guaranteed 15,000 copies; but a severe domestic affliction on my part, and probably the state of public affairs in Paris, prevented any final agreement."

WEEKLY LIST OF NEW ENGLISH PATENTS.

A grant of an extension of a patent for the term of four years, from the 4th instant, of an invention for a certain improvement or certain improvements in the making and manufacturing of axletrees for carriages, and other cylindrical and conical shafts, to Charles Geach and Thomas Walker, the assignees of James Hardy, the original inventor. April 2; six months.

William M'Bride, Jun., of Sligo, Ireland, but now of Havre, France, merchant, for improvements in the apparatus and process for converting salt water into fresh water, and in oxygenating water. April 2; six months.

Alfred Vincent Newton, of Chancery-lane, for improvements in separating and assorting solid materials or substances of different specific gravities. April 2; six months.

Samuel Alfred Carpenter, of Birmingham, Warwick, manufacturer, for a certain improvement in or substitute for buckles. April 3; six months.

Alfred Woollett, of Liverpool, artist, for improvements in gun carriages. April 3; six months.

William Parry, of Plymouth, Esq., for certain improvements in shoeing horses and in horse shoes. April 3; six months.

Henry Dunington, of Nottingham, manufacturer, for improvements in the manufacture of looped fabrics, and in the making of gloves and hatbands. April 3; six months.

James Godfrey Wilson, engineer, of Chelsea, and William Pidding, of Elizabeth-street, Pimlico, for improvements in obtaining perfect combustion, and in apparatus relating thereto, the same being applicable to every description of furnace and fire-place, as also to other purposes where inflammable matter or material is made use of. April 3; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.		No. in the Register.	Proprietors' Names.	Addresses.	Subject of Design.
Mar.	29	1829	Henry and John Foster	Liverpool	Telegraphic ship signal lantern.
	30	1830	William Bennett	Percival-street, Goswell-road	Shaving brush.
	31	1831	Richard Jones	Carr-street, Ipswich	Improved fire-escape.
	,,	1832	John Whitehead	Preston	Reciprocating spiral meter.
April	3	1833	Benjamin Nicoll	Regent's-circus, and Lombard-street	Jackets for rowing, cricketing, &c.
	,,	1834	Francis B. Oerton	Walsall	Bit for horses.
	,,	1835	Richard Garrett	King-street, Whitehall	Double piston cornopean.

Advertisements.

PATENTEES, WHARF ROAD, CITY ROAD, LONDON.

GUTTA PERCHA COMPANY.

Wharf Road, City Road, London.

IT cannot now be doubted even by the most sceptical, but that GUTTA PERCHA must henceforward be regarded as one of the blessings of a gracious Providence, inasmuch as it affords a sure and certain protection from cold and damp feet, and thus tends to protect the body from disease and premature death. Gutta Percha Soles keep the feet WARM IN COLD, AND DRY IN WET WEATHER. They are much more durable than leather, and also cheaper. These soles may be steeped for MONTHS TOGETHER in cold water, and when taken out will be found as firm and dry as when first put in.

Gutta Percha Tubing,

Being so extraordinary a conductor of sound, is used as speaking tubes in mines, manufactories, hotels, warehouses, &c. This tubing may also be applied in Churches and Chapels, for the purpose of enabling deaf persons to listen to the sermon, &c. For conveying messages from one room to another, or from the mast-head to the deck of a vessel, it is invaluable. For greater distances the newly-invented Electric Telegraph Wire covered with Gutta Percha is strongly recommended.

Mill Bands.

The increasing demand for the Gutta Percha strapping for driving bands, lathe-straps, &c., fully justifies the strong recommendations they have everywhere received.

Gutta Percha Pump Buckets, Clacks, &c.

Few applications of Gutta Percha appear likely to be of such extensive use to manufacturers, engineers, &c., as the substitution of it for leather in pump buckets, valves, &c. These buckets can be had of any size or thickness WITHOUT SEAM OR JOINT; and as *cold water will never soften them,* they seldom need any repair.

Gutta Percha Picture Frames.

The Gutta Percha Company having supplied HER MAJESTY THE QUEEN with several elaborate Gutta Percha Picture Frames for Buckingham Palace, which have been highly approved by the Royal Family, fully anticipate a great demand for frames from the nobility throughout the country. In order that the picture-frame makers may not be injured, the Company will supply the trade with the mouldings, corner and centre pieces, &c., and allow them to MAKE UP the frames. Pattern books for the trade are now ready.

Gutta Percha soles, solution, inkstands, card-trays, medallions, picture-frames, brackets, mouldings, window-blind cord, soap-dishes, tap-ferrules, cornices, vases, fire-buckets, bowls, pen-trays, stethoscopes, thin lining, thread, flower-pots, ear-trumpets, &c., &c., manufactured at the Company's Works, Wharf-road, City-road, London; and sold by their Wholesale dealers in town or country.

Neuber's Improved Liquid Glue,

Impervious to DAMP or HEAT, perfectly free from smell, and ready for immediate use.

FOR WOOD, METAL, STONE, MARBLE, IVORY, SLATE, GLASS, CHINA and EARTHENWARE, Plaster Models, Paper and Pasteboard, and various other purposes, this cement will be found a most invaluable acquisition. Sold by all Chemists, Oil and Colourmen, Stationers, &c.; and also at the Patentees, Messrs. NEUBER and WATKINS, Varnish and Japan Manufacturers, 549, New Oxford-street, and 76, Long Acre; where samples may be obtained, or forwarded, free, on receipt of 12 postage stamps. Price, Pale, 12s., Dark 8s. per gallon; and in Bottles at 6d., 1s., and 1s. 6d.

All Letters, Orders, &c., to be directed to 549, *New-Oxford-street.*

EXTRACTS FROM THE LONDON PRESS.

"For repairing anything short of a 'kingdom out of joint,' or 'a broken constitution,' this Improved Liquid Glue seems quite up to the mark. We have tried it on a China dish, a wooden box, and a meerschaum pipe, with equally satisfactory results."—Vide *Builder*, Dec. 30, 1848.

"It will not mix with water, is consequently impervious to moisture, and remains quite unaffected in damp situations. It is incombustible, free from the slightest smell, dries quickly after a joint is made with it, and its adhesiveness and tenacity are, under most circumstances, superior to the common glue.—Vide *Mining Journal*, December 9, 1848.

NOTICES TO CORRESPONDENTS.

A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the Claims of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d. Post Office Orders to be made payable at the Strand Office, to Joseph Clinton Robertson, of 166, Fleet-street.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99a, New-street, Birmingham.—Sold by A. and W. Galignani Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1340.] SATURDAY, APRIL 14, 1849. [Price 3*d*, Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

ROGERS'S REGISTERED WAGON REST.

Fig. 1.

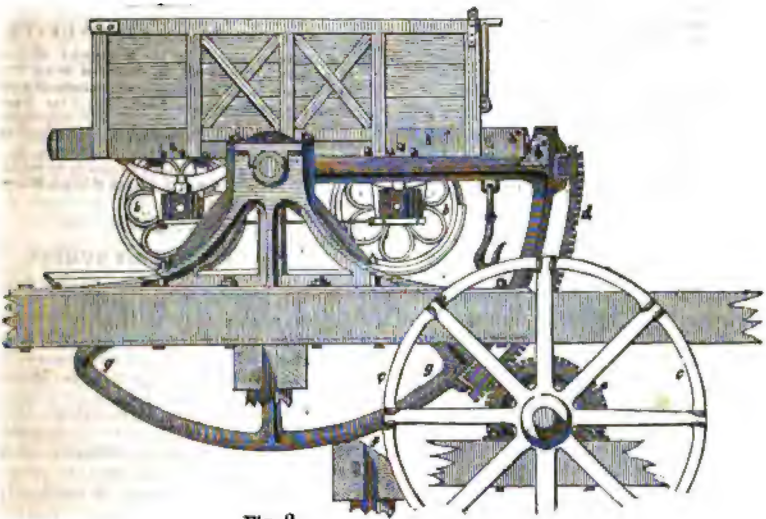
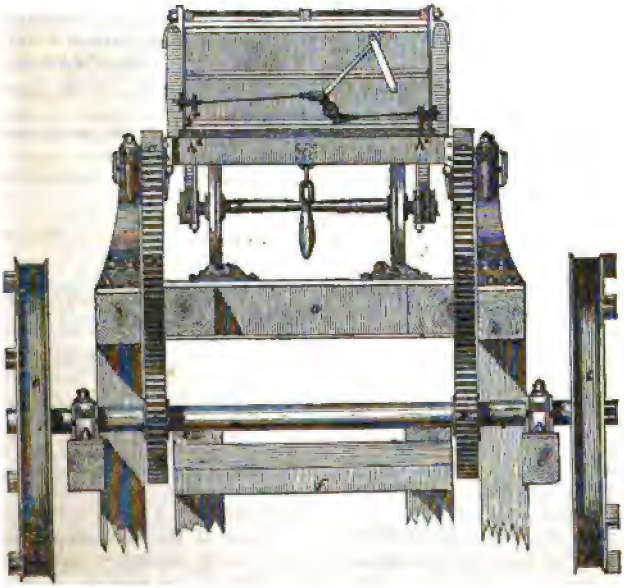


Fig. 2.



MR. ROGERS'S DESIGN FOR A REST FOR THE FORWARD ENDS OF LOADED WAGONS OR CARRIAGES WHILE BEING TIPPED.

[Registered under the Act for the Protection of Articles of Utility. Mr. E. Rogers, of Abercarn Collieries, near Monmouth, Inventor and Proprietor:]

The object which this design is intended to effect has long been a desideratum. The mode in general use of unloading coal wagons, is to raise one end to such an elevation as to cause the load to slide out, or discharge itself at the other end; but this, by throwing the whole weight of the wagon and its load on the forward springs, greatly injures the wagon, the springs become set, the sole bars often split, and the guards strained. Carriages tipped in this manner are, after a very short use, often from 5 to 6 inches lower or out of level at the front part. The load is thus conveyed along the line of rail upon an inclined plane, and at every sudden stoppage of the train the doors are strained. The wear and tear of tipping or unloading endways, has been the principal reason for the introduction of other forms of wagons; as, for instance, carriages with doors in the bottom, and loose boxes or bodies conveyed on carriages, now so extensively used in the North of England. Both these plans have considerable disadvantages compared with the mode of unloading endways, but that also is objectionable, as we have said, on account of the injury done to the wagon.

Mr. E. Rogers, the inventor of the plan, represented in the prefixed engravings, appears to have much reduced the difficulty of tipping endways, by the introduction of a bar or rest, which receives the weight of the wagon and load through the buffers or end of the sole bars during the act of tipping or unloading, and thus relieves the strain on the springs and guards.

The parts composing this design are represented at $h^* h^*$, in figs. 1 and 2; fig. 1 being a side view, and fig. 2 an end view of a swinging or moveable platform bearing a wagon to be tipped; *a*, is a platform, suspended so as to cause the tipping of a wagon, *b*, when brought upon it in a loaded state; *c c*, are brake wheels by which the tipping is governed through the medium of the toothed segments *d d*, and pinions *e e*, on the shaft of the brake wheels.

The inclination of the platform is determined by the stop *f*, and the platform is returned after the discharge of the load by the weight of the iron segments, *g g*; but the form of the platform, and the mode in which it acts and is governed, form no part of the design, and are not material to the useful effect of the part now to be described. The rest to which this design applies is represented at $h^* h^*$, and consists of two sloped or curved surfaces of timber or other material fixed opposite to and intended to receive and support the two buffers, $b^* b^*$, or other forward ends of the framing of the wagon or carriage, so as to relieve the front springs from the additional pressure at the time of tipping.

These surfaces are firmly secured to the moveable platform.

SPLITTING SHEETS OF PAPER.

Sir,—Some time ago it was announced that a journeyman bookbinder (if I rightly remember) had succeeded in splitting printed sheets of paper—such as the *Illustrated London News*, bank notes, &c. As there seems some importance attached to the discovery of the process, may I be permitted to put in a claim of priority for the accomplishment of the same thing, and likewise of applying it to a useful and ornamental purpose. For several years (beginning about 1828) I was in the habit of occasionally making white wood boxes, of various kinds, which I ornamented by Indian ink drawings, or by transferring, in the ordinary way, impressions from engraved plates, wood-cuts, or from lithographic stones. But the inverting of landscape views was a great defect in this mode of transferring. This induced me to adopt a way of splitting the sheet, so as to leave the least quantity of fibre compatible with leaving the ink undisturbed; so that, when transferred and properly varnished, the grain of the wood appeared as distinctly as if no other substance intervened beside the varnish.

With this I hand you a description of the mode by which I accomplish the splitting previous to transferring.

I am, Sir, yours, &c.,

F. JOHNSTONE.

Wandsworth Common,
March 13, 1849.

Mode of Splitting a Sheet of Paper, and Transferring the same to Wood.

If the sheet is sized, soak in hydrochloric acid, much diluted with water, till the size is rendered perfectly soluble in moderately warm water. When well washed, press it gently between blotting paper. While still damp, lay it between two sheets of smooth, firm paper, previously coated with a solution of isinglass or other clear size on one side. Press the sheets well together, and leave them till perfectly dry. Now, by carefully separating the two outer sheets, the middle one will be evenly ruptured or otherwise, according as one sheet is bent more than the other during the process of separation.

The sheet intended to be transferred may be reduced still farther by carefully rubbing the back with fine glass paper, when it may be transferred; the wood having had a coat or two of clear turpentine varnish previously, the last coat being in a tacky state. When the varnish is thoroughly dry, the outer sheet should be moistened with water till the size beneath is sufficiently softened to permit of its being stripped off. The size should then be carefully washed away, and the paper dried, when it will be fit to receive the requisite coats of varnish, to give transparency and body to admit of polishing.

The mode of splitting a printed sheet, I think, must be very obvious to all who are familiar with the modern practice of preparing the flexible backs of the finer quality of books previously to the pasting on of the morocco covering.

J. J.

ON ZERO SYMBOLS. IN A LETTER FROM PROF. YOUNG TO MR. COCKLE.

Sir,—I have much pleasure in handing you the accompanying papers for publication in the *Mechanics' Magazine* :—

To James Cockle, Esq., M.A., &c.

My dear Sir, — I have just read the remarks of your ingenious correspondent, Mr. R. Harley, in your paper on "Algebraic Symbols," in the last Number of the *Mechanics' Magazine*, and in which you have paid me the compliment to express a wish that I would contribute some observations on this subject. My time and thoughts, however, as I believe you are aware, are too much occupied with other things to leave me sufficient leisure to attempt anything like a "disquisition on zero symbols;" but I will here put upon paper, and submit to your opinion, a few ideas which a perusal of the paper has suggested.

I find no fault with the equation $3\cdot0=2\cdot0$; understanding it to mean simply that a total absence or exhaustion of all magnitude, or value, is equally expressed by either side. I view each member of the equation merely as a result, without any regard as to how it has been obtained, and I find that all that the equation affirms is that *nothing* is equal to *nothing*. But I cannot agree that this admission involves the admissibility of the statement $+0=-0$. *Here* is something more than a mere affirmation as to *value* or *result*: there is an express condition as to the mode of production; the first member declares that it is a *positive* quantity that has vanished, and the second that it is a *negative* quantity, or, to be perhaps more explicit, the quantity has, in the one case, vanished positively, and in the other case negatively. I don't deny, any more than in the former equation, that the resulting *values* are equal; but I cannot refuse its due weight to the declared fact that these values have totally different origins, and are impressed, each of them, with a distinct character, compelling attention to this; they are thus *not* in every respect equal; and it would be easy to show how we might be led into palpable error by assuming such equality.

Suppose that in any trigonometrical investigation our symbol, x, represented the cosine of an arc, which arc it was our object to determine; suppose, moreover, that the inquiry concerned only arcs between the limits, 0 and 360°. Imagine that we had arrived at the result $x=+0$; would it be allowable, instead of preserving this result in all its integrity, to change it into $x=-0$? Certainly not; since in so doing we should change the arc really determined, namely 90°, into 270°; and thus commit a palpable error.

I cannot but consider the reasoning by which (2) is deduced from (1), at p. 293, to be objectionable. Seeing that + is prefixed to 0, in (1) there is thus introduced a distinct condition as to *generation*, a condition which is violated in (2).

It is not only in reference to these *zero*-

symbols that stipulations as to generation, in addition to statements as to value, must be allowed to have their full influence in algebraic reasoning. For example, who would deny that $1^2=1$? Yet the mind, as well as the eye, recognises a difference between these two units, though not a difference as to value or result; and if this difference be wholly disregarded, see to what we might be led:

Since $1^2=1$, therefore, taking the logarithms,

$$2 \log. 1 = \log. 1,$$
$$\therefore\ 2=1.$$

which is of course absurd. Now in this example, as in the case of the zeros, a condition, which has no effect upon mere value, is brought into play in our subsequent deductions, and betrays us into error; and although we can assign no difference, as to value, between $+0$ and -0, yet we cannot say that these are in every respect the same, without also saying that $+$ is the same as $-$.

Pray excuse me for putting you off with these brief and hasty suggestions, instead of submitting to you the results of a more mature deliberation; and believe me,

My dear Sir,
Very faithfully yours,
J. R. YOUNG.

Belfast, April 3, 1849.

Professor Young, with a note dated "Tuesday Evening," favoured me with the following addendum to the preceding letter:—

The equation $3\cdot0=2\cdot0$, noticed above, has arisen from substituting a certain number for x in the two members of a particular equation, and as the result is in each case nothing, I regard the number, so substituted, to be admissible as a root of that equation. I am not at liberty, in reference to the particular equation alluded to, to say that $5\cdot0=2\cdot0$, or $m\cdot0=n\cdot0$, for this would be to violate the condition which connects the true members of this specific equation together; the zeros finally brought out, have to one another the ratio of 3 to 2, and no other ratio; but when, as in your correspondent's second letter, it is proposed to take $2\frac{1}{2}\cdot0$ from each side of the zero-equation, the hypothesis is introduced that the zeros are in a ratio of equality; and this contradictory hypothesis sufficiently accounts for the absurd conclusion, $\infty=0$.

I have only further to add that I cannot admit the distinction between what is "actually zero," and "a quantity less than any assignable number;" and I fear that a sagacious and persevering learner would soon perplex a teacher who should insist upon any such distinction; the only thing less than any assignable number, is *nothing*—notwithstanding the apparent paradox in the expression; for any quantity short of nothing is confessedly too great.

Respecting the difficulty mentioned in the first letter, I have nothing to say; you have explained it exactly as I should have done, and I dare say the explanation will prove satisfactory.

And, together with a short note dated "Belfast, April 7, 1849," I have received the following additional remarks from Professor Young:

If 0 be admitted among the symbols of arithmetic—and we have really no alternative—for like $\sqrt{-1}$, it presents itself uncalled for, then it must conform to the general laws of calculation. That there should be any more difficulty in bringing these laws to bear than in the case of other arithmetical symbols, arises mainly from our habit of using the same mark for things which, though they furnish no arithmetical difference, yet are not necessarily in a ratio of equality. You object to $3\cdot0=0$, no doubt from understanding the hypothesis to be that the two zeros are in a ratio of equality, whereas, for the equation to be true, the ratio must be as 1 to 3. And it is on like grounds that I regard the equation $0=-0$ as inadmissible; the ratio here being, not 1, but -1. There is an ingenious paradox in reference to these zeros, which must, I am sure, have been familiar to you when at Cambridge; it is printed in Wright's "Alma Mater," and is to this effect:

By common multiplication,

$$x^2-x^2=(x+x)(x-x),$$

But

$$x(x-x)=x^2-x^2,$$

therefore

$$x(x-x)=(x+x)(x-x).$$

Consequently, expunging the factor common to both sides,

$$x=x+x=2x,$$
$$\therefore\ 1=2!$$

I advert to this quibble here because of its connection with these remarks; and because, moreover, I have never seen any satisfactory explanation of it; the flaw is always affirmed to exist in the final step, the division by $x-x$, or zero. But this cannot be, since the *very same* zero-factor is removed from each side of the equation. The fault lies in the premises; the *argument* is correct; it is not true that

$$x^2-x^2=(x+x)(x-x),$$

for this is not an allowable corollary from

$$x^2-y^2=(x+y)(x-y).$$

In this latter case, where x any y are assumed to be different, we have to deal with finite tangible quantities; and, in connection with these no record need be kept of any zeros which may enter into combination with them through the signs + or −. But when zeros are the very things with which we are dealing, we cannot, of course, throw any of them away, or suppress all trace of them with impunity. The second member of the original equation, the multiplication being performed, and no suppressions made, is

$$x^2+x^2-x^2-x^2,$$

$$\text{or } (x^2-x^2)+(x^2-x^2),$$

which, we see, is just the double of the first member; the error is thus in the premises, and by correct reasoning it is transmitted to the conclusion.

I need not say that I think that the above will prove interesting to your readers. I shall defer my remarks upon it for the present. I am, Sir, yours, &c.,

JAMES COCKLE.

2, Church-yard Court, Temple, April 9, 1849.

PLATINUM, ITS NATURE AND OFFICE.

"Secundam naturam, secundam Deum."

Sir,—It is said, that if *platinum* were not so expensive, a complete revolution would be made in *organic* chemistry. Hence it appears that the presence of this metal influences in a peculiar manner the formation of organic compounds. Now, at present we know little or nothing of *vital* chemistry, animal or vegetable. *Assimilation* is only a name for a *fact*, and when we speak of it as a *process*, we delude ourselves if we allow the definition of the word to convey an idea of the *modus operandi*. Under the influence of vital energy in the stomachs of animals, we find changes take place in organized matter which we cannot imitate, and which some despairing philosophers say we never shall imitate, because we have not the vital principle to play with. But is not all animal chemistry electro-chemical? Consider the importance of platinum in the galvanic battery—the part it plays as the negative pole—how it facilitates the evolution of *chemical force* by its eager reception of it. The connection is no sooner formed between the platinised silver and the zinc, than the force residing in the zinc (perhaps the attraction of aggregation) which resisted the affinity of the acid, begins to escape, and the acid combines with the chemically disintegrated metal. It is in this way, I imagine, that the presence of platinum facilitates the formation of compounds at the positive pole of a battery; and it cannot but be considered confirmatory of this view, that we find the same power—the attraction of aggregation—which was evolved from the zinc, *again deposited*, as it were, in the electro-plate, in the same state in which it had existed in the zinc. The metallic zinc has become a salt, and the salt of the other metal has become metallic—the attraction of aggregation has been *transferred*.

Now, all vital chemistry—which, be it remembered, is the source and origin of organic chemistry, in which we vainly attempt to imitate the phenomena of the former—all vital chemistry is carried on in an electro-chemical laboratory. Vegetation is the natural conductor between the earth and the firmament, and it is vegetation which first converts inorganic matter into organic compounds. These compounds are first produced in the natural conductors of the very force the evolution of which is, as we have seen, so much influenced by platinum. And where do we find these organic compounds elaborated into their higher forms? In the stomachs of animals, surrounded by nerves, the conductors of an analogous principle. When, therefore, we find that it is only by means of *platinum black* that we can obtain a direct combination of some organic substances, how can we so long fail to perceive that the only avenue to the arcana of organic combination is that which is opened to us by the analogy here suggested. It is only under the influence of the natural agent that we can expect to arrive at natural results. The electrical *plus* and *minus* are the only powers that can extricate organic chemistry from the labyrinth in which its researches are at present involved.

I am, Sir, an old reader and quondam correspondent,

A.

SIR ROBERT PEEL'S IRISH REMEDY OF ANCIENT DATE.

Sir,—In the Memoirs of that enlightened philosopher and true Irish patriot, Richard Lovell Edgeworth, by his cele-

brated daughter, Maria Edgeworth, it is related, that he undertook, at the request of certain commissioners appointed by Government, to inquire into the practicability of reclaiming the bogs of Ireland, the survey of a district comprising above 34,500 English acres, and made a report thereon, which was published among the Parliamentary Papers for 1810. His general view was, that the reclamation of the vast tract of bog land which he examined, was not only practicable, but that it would prove highly and quickly profitable to individuals, and advantageous in every point of view both to Ireland and to Great Britain. The chief obstacles in the way, were (then as now) *the landlords;* their poverty—their pride—their improvidence—their family settlements, mortgages, leases for lives, &c.—their inability to help themselves, and the impossibility (as things were) of their being helped by others—forming altogether a "knot" which "no hand but that of the legislature could untie or cut." Mr. Edgeworth discussed the question of the legislature's right of interference in such a case; and this right he laid down in the following remarkable words, which he quotes from a paper published in the *Philosophical Transactions*, no less than one hundred and eighty-eight years ago (Lowthrop's Abridgment, vol. ii., p. 732*):—

"*An Act of Parliament should be made that they who do not, at such a time, make some progress in draining their bogs*, SHOULD PART WITH THEM TO OTHERS WHO WOULD."

"This," continues Mr. Edgeworth, "is strict justice in every nation upon earth. No man, from prescription or from any grant, has a right *to monopolise and withhold the soil from cultivation*."

The very principle, this, of Sir Robert Peel's measure; enunciated at first with reference to bog lands only, but equally applicable to land of all sorts, when it falls into hands incapable of performing those duties which attach to this as to every description of property.

I am, Sir, yours, &c.,

AN IRISH READER.

* By Mr. W. King. "On Improving and Draining the Bogs and Loughs in Ireland."

DAVIES'S ROTARY ENGINE.

Sir,—My reply to "A. Z." will necessarily be short. There are only one or two points to which I need allude.

Davies's engines must always be understood to be a double engine, or if "A. Z." likes it better, two engines working on the same main shaft. It has, therefore, *no dead point;* but as I have never stated Davies's engine to be singular in this particular, I have no intention of disputing the fact, "that the fly-wheel is dispensed with, and the dead points are overcome in reciprocating engines, by employing two engines acting at right angles to each other."

"A. Z." is wrong in saying, "in the latter the fly-wheel is requisite to carry the crank through only 15° on each side of the line of centres," because, for every two feet through which the piston of a reciprocating engine moves, the crank-pin moves through 3·1416 feet, and as there are 360° in a circle, the fly-wheel must render assistance through 131° nearly.

The comparative weight of two pieces of machinery requiring proportionally the same quantity of workmanship, furnishes a comparative estimate of the expense; and this is true, whether the cost price is 100*s.* per cent. for manufactured machinery, or 5*s.* for the iron in a rough state.

The conclusion of "A. Z.'s" letter is vague and contradictory. In the last paragraph he says, "If the method employed by Mr. Davies for keeping the piston steam-tight, as it revolves over the surface of the cylinder, be not objectionable from want of elasticity, it becomes an important improvement, as obviating what has hitherto constituted *the chief difficulty* in rotary engines of whatever construction;" and in the very next sentence he observes, "but I am compelled to say that I think his engine is deficient in *the essential* point of a rotary engine." How will he reconcile these discrepancies?

I am, Sir, yours, &c.,

WILLIAM DREDGE.

London, 10, Norfolk-street, Strand,
March 28, 1849.

SIMPLE METHOD OF SQUARING NUMBERS IN ENGINEERING CALCULATIONS.

Sir,—Having often found the following method of squaring numbers very convenient, I am induced to lay it before your readers, in the hope that it may prove useful to those who are much engaged in engineering calculations.

It involves no new principle, but is merely an adaptation of a well-known prop. of the second book of Euclid, that $(a+b)^2=a^2+2\ ab+b^2$.

I will always suppose the number to be squared to be under 100, as it becomes rather too complex to be an improvement beyond that; divide it into two parts (a and b), the one (a) the ten, and the other (b) the unit, then proceed by the formula; for example, let 83 be the number proposed, then

$$83^2=(80+3)^2= \quad 80^2 = 64$$
$$6\times8= \quad 48$$
$$688$$
$$3^2 = \quad 9$$
$$6889$$

Now, this seems roundabout, rather than shorter; but, for *mental calculation* (for which it is intended), it is done very readily. If the same were to be squared on paper, the labour might be greatly abridged thus:

83	$3^2=9$	1st fig.
6889	$2\times3\times8=8$	2nd ,, and carry 4
	$8^2-64+4=68$	

47	$7^2=$	9 and carry 4.
2209	$8\times7=56+4=0$	.... 6.
	$4^2=16+6=22.$	

But, to return to mental calculation, there are a great many numbers which may be squared almost instantaneously.

1st. In all numbers where the figure 1 or 2 is a factor, the method of abridgement is so very evident, and would so soon suggest itself, that it is sufficient simply to indicate it.

2nd. Numbers which have the ten, double of the unit may be squared thus, say 84:

$$\begin{array}{rr} 8^2= & 64 \\ & 64 \\ 8^2= & \overline{704} \\ & 16 \\ 4^2= & \overline{7056} \end{array} \qquad \begin{array}{r} 63 \\ \hline 3969 \end{array} \qquad \begin{array}{r} 36 \\ 36 \\ \hline 396 \\ 9 \\ \hline 3969 \end{array}$$

3rd. Conversely, where the unit is double the ten—as

$$\begin{array}{r} 48 \end{array} \qquad \begin{array}{r} 64 \\ 64 \\ \hline 704 \\ 16 \\ \hline 2304 \end{array} \qquad \begin{array}{r} 36 \end{array} \qquad \begin{array}{r} 36 \\ 36 \\ \hline 396 \\ 9 \\ \hline 1296 \end{array}$$

4th. In numbers which are multiples of 5—as 75:

$$7^2+7=5625=(65^2)=6^2+6=42\cdot25\ \ 95^2=9^2+9=9025\,;$$

here the two right hand figures are always 25, and the other two the square of the ten, plus itself, or adopting the same notation as before,

$$a^2+a \text{ and } 25.$$

5th. Where 5 is a ten, as

$$58^2= \begin{array}{r} 25 \\ 8 \\ \hline 3364 \end{array} \qquad 57^2= \begin{array}{r} 25 \\ 7 \\ \hline 3249 \end{array} \qquad 54^2= \begin{array}{r} 25 \\ 4 \\ \hline 2916 \end{array}$$

6th. Conjoining 2nd with 4th, we have in cases such as the following—

$$(94\cdot5)^2= \begin{array}{r} 81 \\ 81 \\ 20\cdot25 \\ \hline 8930\cdot25 \end{array} \qquad (73\cdot5)^2= \begin{array}{r} 49 \\ 49 \\ \hline 539 \\ 12\cdot25 \\ \hline 5402\cdot25 \end{array}$$

The principle upon which these are based, is so very well known, that I cannot help thinking, that so evident an adaptation must have occurred to others, and perhaps be in practice; but I have never yet seen or heard of its being so, otherwise I should not have troubled you with this short paper.

A. C. O.

Oldham, Oct. 17, 1848.

MR. J. W. COCHRAN'S PATENT SHIP TIMBER-SAWING MACHINERY. CONCLUDED FROM PAGE 319.

To show more clearly the mode in which the saws are mounted and worked, we have given in fig. 6^a, a front elevation of the machine with all the parts removed that have no relation to this branch of the invention, and also in figs. 6^b, 6^c, 6^d, 6^e, 6^f and 6^g, 6^h, some of the more important of the minor details. The sawgate is represented as fitted with two saw blades with their respective shackles and sliding frames, but as both saws are actuated by precisely similar means, we shall, for the sake of greater distinctness, confine ourselves to describing the parts belonging to one saw blade only.

The sawgate, M M, consists of two top and bottom rails, C C, which are connected together by the upright rods, N N, to the lower ends of which are jointed the rods by which motion is communicated to the gate from the cranks of the main driving shaft. The saw blade, *l*, is attached at top and bottom to two cylindrical axes, G G, which are separately represented along with the parts peculiar thereto in figs. 6^b, 6^c, 6^d, 6^e; figs. 6^b, 6^c, 6^d, being side elevations, and fig. 6^e, a cross section on the line E F, of fig. 6^e. The axes, G G, are hollowed out in the centre from *a* to *b*, as represented in the cross section, fig. 6^e, and fit by means of the parts so hollowed out upon the projecting pieces, H H, which form the extreme ends of the top plates of the shackles, I I. The form of these projections, H H, is shown separately in fig. 6^f, which is a plan of the top plate of the shackles. When the axes, G G, are fitted upon H H, and the saw connected to them by the pins *c c*, the saw blade is brought to the proper degree of tension by means of the top screws, $X^1 X^1$. The points of these screws, which are conical and made of hardened steel, take into hollows formed in the pieces, H H, so that the saw blade has thus, in so far as respects the screws by which it is stretched, perfect liberty to turn round in any direction, the friction of the bearing parts presenting a very trifling obstacle to its rotation. The saw is, however, limited at the same time in respect of angular motion by the sides of the recesses formed in the axes G G, and the neck which connects the bearing points, H H, of the shackles, I I; the range allowed to the saw by the parts just described being still sufficiently extensive for all practical purposes. (It may be turned till it stands at an angle of 45 degrees, or even a greater angle, with the central line of the sliding carriage upon which the wood to be cut is placed). It is to be observed, that when the saw is stretched, the points of resistance to its tension are not the rails of the sawgate; for the strain falls entirely upon the shackles or buckles, I I, which together with the rods, L and M, form a frame complete in itself, which fits accurately into, and slides upon the sawgate. By this improved method of mounting the saw, great facilities are obtained for connecting and disconnecting it from the frames, while the friction of the bearing points being reduced to a very small amount, the workman is enabled to direct the course of the saw in any intended line with great precision and ease.

On the rod or strut, L, there is closely fitted a hollow shaft or tube, O^o, two ends of which bear against the top and bottom shackles, I I. So that by this means it is prevented from moving in a longitudinal direction upon the rod L, but is still left free to be turned round upon it, as on an axis. To the upper and lower ends of the shaft or tube, there are securely fixed cross arms, $O^2 O^2$, corresponding with similar cross arms, $P^2 P^2$, which are keyed upon the axes, G G, of the saw. These two sets of cross arms are again connected with each other by rods, *q q*, (a plan of which is given in fig. 6^g,) so that, if the hollow shaft, O^o, be made to turn by any means either to the right or left, an equivalent movement of the saw upon its axes, G G, takes place at the same time. P P, are two round rods, which are secured to the upright standards of the framework of the machine, and occupy positions parallel to each other, and also parallel with the sawgate. T is a bridge, or sliding bearing, which is free to slide to and fro upon the rods, P P, that is, from one side of the sawgate to the other, being attached to the rods by the bosses, *d, d, d, d*. U and P^s are two bosses inserted into the upper plate of the bridge T, in such a way, that they are at liberty to revolve in the holes into which they are inserted; while they are prevented from getting out of their places by collars, *f f*, formed on, or affixed to their upper and lower ends. One of these bosses, U, embraces the upright hollow shaft, O^o, and allows of its moving freely up and down within it. On the side of the hollow shaft, O, there is a feather, *e*, which takes into a corresponding groove formed in the boss, U, so that if the boss is made to revolve, the hollow shaft must go round along with it. W is a worm-wheel which is attached to, or formed in one piece with the brass U, and gears into an endless screw X, upon the end of which there is a hand-wheel, X^2, so that

the attendant may be enabled through the intervention of the endless screw X, the worm-wheel W, the hollow shaft O, the cross-arms, O^2, P^2, and the rods *q q*, to cause the teeth of the saw to be directed at pleasure, more or less towards the right or

Fig. 6b.

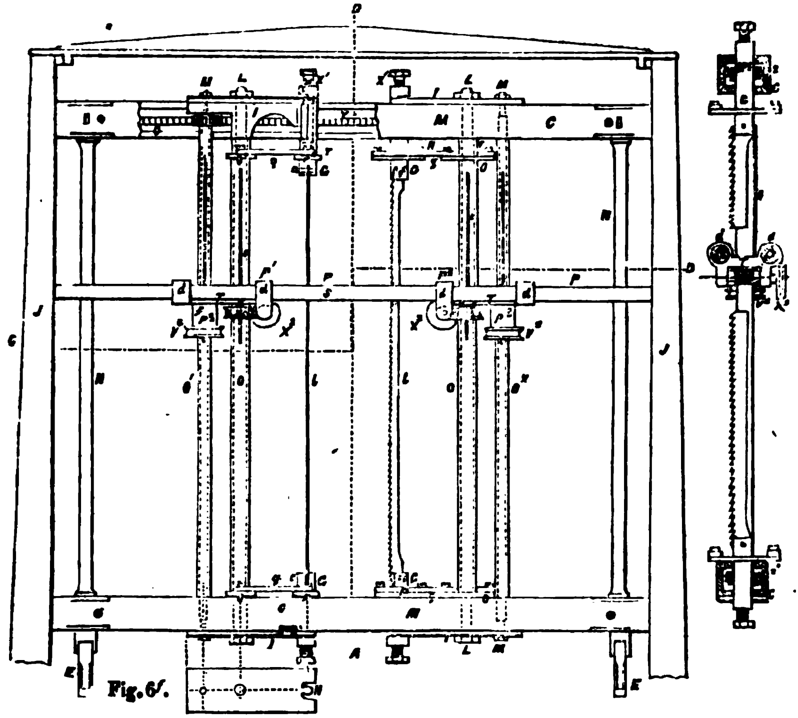


Fig. 6f.

ig. 6g.

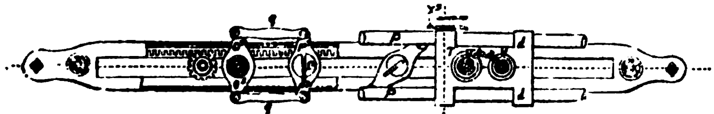


Fig. 6c.

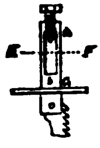
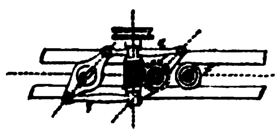


Fig. 6d.

Fig. 6e.

Fig. 6h.



left, according to the form desired to be given to the piece of wood.

When the saw has been inclined towards either side of the sawgate (by means of the apparatus before described) during the operation of cutting a log or block of wood,

the regular feeding in of the wood takes place by the advance of the travelling-bed under the sawgate. The saw would, therefore, very soon be broken unless the shackles were made by a free lateral motion, or some other means, to advance towards that side of the sawgate to which the teeth of the saw are directed. To effect this object, the arrangement next to be described is adopted: V^2 is a hand wheel fixed upon, or made in one piece, with the brass, P^2, which is connected with a hollow shaft, O*, upon the rod, M; being in this respect exactly similar to the hollow shaft, O^o, and brass, U, before described. The hollow shaft, O*, has pinions, Y Y, affixed to each end, which gear into racks, Y^2Y^2, which last are fixed to the upper and lower rails of the sawgate. In general, the draft of the saw itself is sufficient to cause the shackles to move along the sawgate; but whenever any obstruction to the lateral movement is experienced, all that the attendant has to do is to turn the hand wheel, V^2, in the required direction, which causes the pinions, Y Y, by gearing into the fixed racks, to draw the shackles and saw along with them.

The arrangements which have just been described for regulating the lateral and simultaneous movement of the shackles, both at top and bottom of the sawgate, serve the further purpose of keeping the saw at all times vertical in the sawgate, it being impossible, on account of the racks and pinions, for one of the shackles to be moved without a corresponding movement being produced in the other.

Not only may the machine be worked with either one or two saws at a time, but one saw may be used to cut in a curvilineal direction, while the other cuts in a straight line.

"Thus if both or either of the sides of a log should be intended to be cut in a curved or irregular line, that object may be attained by turning, from time to time, the saw, in the required direction; and when simultaneously making two cuts in a log by my said machine, it is not at all necessary that the cuts should be made parallel with each other, for the lateral movements of the saw within the sawgate, being perfectly independent of each other, each saw may be turned in the required direction for the purpose of making the intended cut in the line described, however much the two lines to be cut by the two saws may vary from each other.

"Neither is it necessary that two saws should be actually used for the purpose of cutting timber in one of my said machines, although two saws may be mounted in the sawgate; for, the peculiar construction of my said sawing machine may be made available for the purpose of making single as well as double cuts. And if it should happen that the shape into which a piece of timber is intended to be cut requires the adoption of such a mode of proceeding, I can enter one of the saws and commence cutting a piece of timber with it, and after the cutting with one saw has proceeded the requisite distance, I can then enter the other saw also, so that both saws may then proceed with the cutting of the log, or the cutting with either or both of the saws alternately or simultaneously may be varied from time to time as may be required for the purpose of cutting the pieces of timber into the desired shape."

To enable the reader to appreciate duly the merits of the machinery before described, he will do well to refer back to the report of the trial of the action of *scire facias*, brought for the repeal of Hamilton's patent, of which Cochran's was erroneously alleged to have been an infringement (vol. xlix., p. 590). He will there see that the ground on which the jury were led to find a verdict for the Crown was the general inutility of Hamilton's machinery, whether as regards the modes adopted by him of mounting and guiding the saw, or of mounting and turning the log. He will note in particular, how completely the defence broke down, when it was attempted to be shown in evidence, that the most crooked timbers required in shipbuilding, could be cut by means of a machine constructed exactly according to the specification of the defendant. Such timbers had indeed been cut, but only with the help of the roller-rest, which constitutes one of the most prominent features of novelty in Cochran's invention. How superior Cochran's machine is in that and all other respects is so well pointed out in a paper on the subject, drawn up by Mr. J. B. Jordan, the patentee of the well-known carving machinery, and printed for private circulation, that we cannot do better than here lay some extracts from it before our readers:—

"In patents of this kind, where neither party can claim the introduction of any new principle in mechanics, their right to a patent must of course depend on the

utility of the object attained, the perfect adaptation of the various parts, the perfection of the mechanical details, and the *novelty* of the general arrangement for attaining it. If, therefore, it can be shown that the latest patent will accomplish that which is essential, but utterly impossible for the other to do, I presume it would be sufficient evidence of novelty; but if it can also be shown that every mechanical detail, *not common to saw-mills*, is different and far better calculated for the practical accomplishment of its objects, that many of these details have never before been used in saw-mills, and that without those arrangements of the latter (for which there is no substitute in the former patent), these machines could not be used for some of the purposes specified, I presume a case will be made out which I should think too strong for any reasonable man to think of attacking.

"I believe that Mr. Cochran's patent machinery has all these advantages over that of Mr. Smith,* and my reasons for thinking so will be best shown by comparing the methods used by the contending patentees for producing the same results, in sawing a crooked piece of timber into the curvilinear and winding form, which is the most difficult required in the construction of a ship.

"Mr. Smith would fix the crooked log between the toothed dogs or chucks of the horizontal travelling frame, and as he is without any means either of supporting or balancing the great weight of the log, except the very clumsy and inefficient contrivance represented in fig. 8 of his drawings,† I believe that it would not be possible to make even a straight cut through a heavy and crooked log, supported, or rather suspended, in this way, on account of the extreme and powerful vibrations into which it would be thrown by the intermittent action of the saw. The contrivance, No. 8, is worse than useless, as it *would tend to increase the vibrations*.

"Mr. Cochran would fix the same crooked log between the screw-clamps on the eccentric chucks of his horizontal frame, and by adjusting the screws of these chucks would be able to bring a line, passing through the centre of gravity of the log, directly over the centre of the axis, about which it is made to turn, and thus balance the log, so that the means used for controlling its angular position would not have to sustain any portion of its weight.

"He would also give it a solid bearing directly before the saws, by his very beautiful and novel contrivance of a rolling rest, which is made to revolve with the log and remain in close contact with its under surface, whatever may be its angular position. These means are *sound and practical*, and will undoubtedly make the log sufficiently steady to produce good work, whatever may be the *weight and curvature of the piece*.

* * * *

"*Turning the Log on its Axis to obtain the Bevels.*—This is a very important feature in both patents, and much of their success must necessarily depend on the means taken to accomplish it. These means should possess the following properties. Great regularity in moving through the various angles required during the process of cutting. The most solid fixedness which can be obtained. Great facility in changing the rate of motion, or, in other words, the power of regulating the number of degrees which the log shall be turned through while the saw is making a cut of given length, and the power of doing this while the saws are in action,

"Mr. Smith proposes to turn the log by securing a long lever to one or both of the chucks between which the log is fixed, and to place the end of this lever through the slot of a guide-bar attached to framing over the log, in such a way that it can be placed at various angles in a horizontal plane, the angle at which it is so placed governing the rate of change in the bevel of the cut produced, as may be seen by reference to the drawings.

"I appears to me that this plan, taken in connection with Mr. Smith's mode of suspending the log, as already remarked on, is not competent to carry out the specified intention, because the tendency of the bight of a crooked piece of timber to turn down, and the whole strain of the saw acting on it, must be sustained by this lever and guide-bar, which, both from their construction and size, they are evidently incapable of bearing with-

* Mr. Smith was the party in whose name the patent of Mr. Hamilton (an American) was taken out.

† The bar, weighted at one end like a steelyard, referred to in Report, p. 592.

out such an amount of vibration as would either break the saw or shake the log *from its fixings*.

"Mr. Cochran cuts a screw in the edge of the face-plate to which his holding-dogs are attached, and works the tangent screw which gears into this either by hand under the guidance of an index, or by a system of double cones by which the rate of change in the bevel can be determined and raised at pleasure while the saws are in action.

"This system of working is not at all similar to that of Mr. Smith. The method of setting out the different sectional obliquities of the log on a bevel-board, attached to the revolving face-plate, is one of those simple and practical contrivances which every workman appreciates and applies without difficulty.

"I believe these means of turning the log during the process of cutting, taken in connection with the mode of supporting it, will be found perfectly efficient for the production of any bevel which can be required in the construction of a ship.

"*Lateral Motion of the Saws to obtain the Curves.*—Mr. Smith mounts and strains the saw in an interior frame, which frame moves laterally on the top and bottom bars of the sawgate, and he also furnishes the saw with swivels, which admit of its being turned on its axis so as to take up the direction of the line it is about to cut. He turns the saw by the direct application of a forked lever to the saw blade. It appears to me that there are several serious practical objections to these arrangements, which are avoided in Mr. Cochran's patent.

"In the first place, it is generally requisite to take off a slab from each of the curved sides of the log, and it is frequently requisite that these curved sides should be parallel in their bevels, though not in their curvatures. With the above arrangements, I think it would be scarcely possible to do this with accuracy, even on the small and comparatively straight pieces of timber which the other parts are capable of supporting, and I think we may satisfy ourselves on this point and some others, by considering the machine in action. Assuming that the guide-bar has been properly fixed for the first portion of the bevel, and the saw is put in action, it will soon arrive at the first line on the timber where the rate of bevel must be changed. The saw must now be stopped, the guide-bar must be unclamped, and its position altered, and during this operation the timber must be kept in position by some other means, otherwise the saw will be bent or broken by its tendency to swing round on its axis; but supposing all this done, and the machine is ready for progress to the next line of change in the bevel, when the same troublesome and dilatory operation must be again gone through, and so on for the whole length. Neither must we forget that the saw has been twisted into the proper directions to follow the curves by a forked lever applied directly to the blade, which, of course, must produce a very injurious amount of friction, and consequent heat and vibration.

"Suppose, however, that in spite of all these difficulties, the first side of the log is cut, it then becomes requisite to move the saw to the other side, and we must do this either by dismounting the log or dismounting the saw—a choice between two evils: still it must be done, or the other side cannot be cut; and when done, we have to repeat all the steps taken to saw the first side, with the additional difficulty of making the bevels register with those previously cut, by fresh adjustments of the guide-bar at every change. All this must necessarily depend on the care and attention of the workman, and I think he must be unusually skilful if he can produce good work with such means, however long he may take about it.

"Mr. Cochran mounts his saws in shackles, which are attached to a vertical bar of iron, that serves as a strut to strain the saw, and which admits of the saw being strained without throwing the least stress on the top and bottom bars of the sawgate in which it moves laterally. Two saws are mounted in the gate, and each moves laterally independent of the other. They are also at liberty to turn on their axis, and are guided in this motion by a forked lever, *not* applied to the saw blade, but to a flat bar of iron, which is connected with the saw by a parallel motion at each end, thus avoiding all the injurious twisting action and friction on the blade."

[This was Mr. Cochran's first arrange-

ment; but now, as will be seen by the preceding description, he dispenses with the forked lever altogether.]

"The advantages of these arrangements will be more apparent by considering the machine in action; the problem being to cut a heavy crooked log into a varied curve, with parallel but varied bevels, and diverging curves.

"The modes of mounting, balancing, and supporting the log have already been considered, and I have now only to describe the process of cutting. The log is marked out as usual, and the bevels are set out on the bevel-board of the revolving chuck. One workman takes command of the handle by which the tangent screws are set in action for turning the log and rest, while two others direct the saws so as to keep them in the lines of curvature. At every change in the rate of bevel, the little quadrant index must be moved the proper quantity forward on its bar, and its radius set over the next mark on the bevel-board, which can be done while the saws are in action, because the position and fixing of the log are in no way dependent on it. The two saws are thus kept in continuous operation until the piece is complete, having the register or parallelism of its bevels perfect, for they have been produced by two vertical saws at the same time, while at the same time the curves of its opposite sides may have varied to any required extent, because the lateral motions of the saws are independent of each other."

It is a curious fact, that at the very time Hamilton was contending in Court that no roller support was necessary, and concealing from the Court that he did make use of such a support (though not included in his own patent, but borrowed from Cochran's), he had a new patent for England, then unspecified (taken out on his behalf in the name of Barber), of which a roller support constituted the leading feature. We make the following extract from an abstract of this specification given in the *Civil Engineer and Architects' Journal* for January last:—

"The objects of Mr. Barber's invention are to provide, in the first place, for supporting timber otherwise *than at the end* while being cut at the various bevels which may be required. * * * With regard to the support for timber, it consists of a *roller* placed transversely under the log near the saw-frames. This roller is of small diameter, but of sufficient length to receive a log in any portion of the width of the machine, and is supported at each end by pivots in a sawing-frame supported on a journal in the centre of the machine. The journal, which forms a point of oscillation, is carried by an upright in a vertical guide, and is supported on the end of a lever, by which it is either raised or depressed to suit the size of the log. This is effected by the other end of the lever being raised or lowered by a chain wound on a barrel, the spindle of which is furnished with a screw-wheel gearing into an endless screw, actuated by a suitable hand wheel. *The supporting roller being free to oscillate on the central fulcrum, it adapts itself at a suitable angle to the nature or position of the log when turned.*"

What else is this but Mr. Cochran's roller rest, with sundry alterations and additions, introduced for the mere sake of establishing a seeming difference where in reality, there is none? Mr. Cochran's claim is for the employment generally of "oscillating or turning intermediate roller supports, for the purpose of holding, sustaining, or supporting logs or pieces of timber whilst being cut," and it remains for Mr. Hamilton to show that such roller supports were ever employed or proposed by any one else before.

To conclude—there is this grand distinction between the two machines, that Cochran's is in successful public use, and Hamilton's in public use nowhere; that Hamilton's has been tried (at Toulon), and proved an utter failure, while the longer Cochran's is worked, and the more severely its capabilities are tested, the more complete is the satisfaction which it affords.

We have ourselves seen Mr. Cochran's machine at work at the Dockyard, Woolwich, and witnessed the marvelous dispatch and accuracy with which it cuts the most awkward-looking pieces of crooked timber. When we inspected it, however, the mode of regulating the angular direction of the saws, represented in fig. 6[a], and subsequent figures, had not then been applied to it; this was still done by means of the forked lever referred to by Mr. Jordan in his remarks. Mr. Cochran estimates that by dispensing with the forked lever, and by other improvements embodied in the machine as we have here described it, its efficiency and economy have been improved full fifty per cent.

MR. GRAY'S LIFE TABLES AND FORMULÆ.*

It not unfrequently happens that an essay or two communicated to a periodical becomes the germ of an important treatise. The present work furnishes an illustration, with this peculiarity, that it exhibits the development of *two* germs, each of which, though distinct, has fulfilled its part in the production of the goodly fruit now offered to those who have a proper taste for such fare.

The *first* branch of this subject is *Barrett's Commutation Table,* a method originally rescued from obscurity by Francis Baily, but not duly appreciated till after the appearance of Griffith Davies's Table in 1825.† Our Magazine for November and December, 1842, exhibits Mr. Gray's compendious illustration of the valuable principle involved in this form of table.

The *second* branch consists of *Gauss's Logarithmic Sum and Difference Table,* which on its first appearance in Germany, met with as much indifference as the Commutation Table. The columns of the *Mech. Mag.* in June and July, 1844, received from the hand of our author an equally clear elucidation of the merit of Gauss's Table, and its peculiar fitness for life calculations.

It is not surprising that Mr. Gray should be almost irresistibly led, to show the world, what important advantages may be derived by the combination of such materials, and well has he executed the self-imposed task.

The tables to six places of decimals, forming the foundation of the present work, are now first issued from a British press. Table I. furnishes to the argument log. x, the value log. $(1+x)$. It accords with Gauss's original, but has been recomputed with much labour. Table II. exhibits, to the same argument, the log. $(1-x)$, x being always less than unity; this is wholly different from Gauss, and more convenient in use. The form of both tables is assimilated to that which the common logarithmic one has rendered familiar. They occupy sixty-eight pages; and to their construction and *general* use, Chap. I. is devoted.

Chap. II. contains the leading results of the doctrine of compound interest; Chap. III., the fundamental theory of probabilities as connected with human life; Chap. IV. expounds the "Table of Elementary Values," the construction of which, did space permit, we would gladly detail; Chap. V. is on Mean duration of Life and Probabilities of Survivorship; Chap. VI. is occupied with the subject of Benefits on Lives, and the manner of forming *continuously* tables of the values of the principal benefits is fully explained and exemplified; and Chap. VII. fully elucidates the properties and formation of Commutation Tables, both for single and joint lives. It is to the last two chapters that we would particularly point, as exhibiting the mastery which Mr. Gray has obtained over the formulæ, and the skill by which they are moulded, so as to minimize arithmetical labour.

The late Mr. Barrett spent *many years* in computing from the "Northampton" and "Sweden" laws of mortality, Tables so extensive, that they would have occupied in print two quarto volumes. Yet his labours were almost wholly wasted, since even the powerful recommendation of Mr. Baily was unable to secure the funds for printing them! And considering the essentially limited character of all numerical Tables of Mortality, it is evidently more important to provide every possible auxiliary for obtaining *practical results* from the existing and all *future* Tables of Mortality than to make very extensive calculations from any of them. To this object Mr. Gray has directed his efforts, and he has been, in our opinion, signally successful.

After such a labour, our author might well rest on his oars; but we find that, on the contrary, he is engaged with two other gentlemen in computing extensive Tables of Survivorship Assurances; a work which the

* Tables and Formulæ for the computation of Life Contingencies, with copious examples of Annuity, Assurance, and Friendly Society calculations. By Peter Gray, F.R.A.S., &c. Royal octavo. Longman and Co.

† The author has in his last chapter vindicated Mr. Barrett's claim to originality of invention, of which it has been recently sought to deprive him.

actuaries of the present day will, doubtless, eagerly patronize, were it only to remove the professional discredit incurred by their predecessors in the case of Mr. Barrett.

THE PRACTICE OF LIFE ASSURANCE.—DEFECTS AND REMEDIES.*

A sense of the benefits of life assurance, is become so nearly universal among all classes of society, that popular writers upon the subject, now busy themselves less with enforcing these benefits, than with investigating the causes to which it is owing, that what so many approve of, so few practise; that is to say, comparing the total number of the assured with the total population of the country. With one class of commentators, the great obstacle in the way of its more extensive adoption, has been the proprietary system on which most of the older assurance companies were founded, and the alleged striving among these companies to extract as much profit as possible from their customers; while with another, it is the stamp duty injudiciously imposed by the state on policies of assurance, which is the lion in the path. Of both these topics more use, perhaps, has been made than truth will warrant; for though the cheapening of policies can but have one effect (if any), and that a favourable one, yet we seriously doubt whether any man, who had fairly made up his mind to the propriety of effecting an assurance on his life, was ever deterred from doing so, by the consideration of having two or three pounds more or less to pay on the occasion. Very possibly such a consideration might lead a person to effect an assurance for a less sum than he would otherwise do; but what we are now looking to, is not the total amount of the sums annually insured throughout the country, but the ratio which the number of the assurers bears to the whole population. Our firm belief is, that that ratio has been little, if at all, affected by the cost of assurance. The mutual system is, no doubt, the cheapest and best for the assured; yet neither is the proprietary that cormorant affair which some persons, for the sake of recommending the other (and promoting, perchance, by the way, their own private interests), are in the habit of representing. When we see people warmly exhorted not to "*suffer*" life assurance to "become the prey of money lenders and mere profit mongers," we can but wonder at the audacity with which a pseudo-philanthropy sometimes advocates very questionable ends. It seems to be forgotten, or is, at least, carefully concealed from view, that no one is obliged to assure with a proprietary company unless he likes; that there are *many* such companies, whose prices are necessarily kept down by the mutual rivalry among them, and by the competition to which they are exposed at the hands of the mutual establishments; and, that it is no more possible, for persons to obtain beyond an average rate of profit, by underwriting men's lives, than by any other species of adventure which it is open to all the world to embark in.

We have now before us a very clever pamphlet, in which the writer opens up quite a new ground of complaint, and one to which both sorts of companies are confessedly obnoxious,—the mutual even more than the proprietary.

"The progress of life assurance has, unfortunately, been much retarded by disputes and lawsuits—vexatious delays in the settlement of claims, extorted compromises, and protracted litigations, have had the effect of deterring many persons from resorting to life policies as provisions for families or as securities in pecuniary transactions; and it is the object of the following observations to point out the risks to which the assured are exposed by the present method of conducting life assurance business, and an adequate remedy." p. 14.

With this view, the author first investigates what the state of the law is with respect to contracts of life assurance. We suspect that not a few of our readers will be rather startled to learn from the following passage the very slender tenure by which the already countless thousands invested in life assurance are held:—

"By the policy, the assured undertakes to

* Defects in the Practice of Life Assurance, and Suggestions for their Remedy. With Observations on the Uses and Advantages of Life Assurance and the Constitution of Offices. 41 pp. 8vo. Orr and Co. 1849.

pay the premium regularly, and the Company to pay the stipulated sum three months after the death of the assured; provided, that 'every statement, declaration, and all testimonials and documents addressed to or deposited with the Company in relation to the assurance shall be found to be in all respects true.' It is further declared that these statements shall be held as *warranted*, and taken as the basis of the contract, and that the policy shall be void if any 'important information' has been omitted.

"The effect of these clauses, and the important consequences resulting from them, have been determined by decisions of the courts of law; and it is now settled, as we shall show by references to decided cases, institutional writers, and authors of repute; that if in the statements referred to, and which are declared to be the basis of the contract, and to form matters of warranty, any fact, whether material or immaterial, has been erroneously stated, whether intentionally or not—or if any information considered important has been omitted to be communicated, although the party applied to for information did not consider the omitted fact to be of the slightest importance, *the policy is void, and all premiums paid become forfeited to the Company*. We shall find that it is not enough that the written proposal and declaration made by the assured *are unobjectionable*. The friends' report, and that of the medical referee, and all statements made by the person whose life is the subject of assurance, are regarded in the eye of law as statements of the assured party, although he neither wrote them nor had an opportunity of seeing them. The policy is so prepared that the assured enters into a positive engagement that all these statements are, in point of fact, strictly and literally true, whether he was aware of them or not. Such an engagement being, in legal language, a *warranty*; and the effect of a warranty being to render the facts alleged in it a condition precedent of the assurer's responsibility, it follows that the obligation undertaken by the Office is only effectual 'if' and 'in the event that' each of the many statements, whether material or of no importance, is *literally* as it has been represented.

"Many of the questions contained in the several documents issued by the Company are trifling, and seemingly unimportant; and, as Mr. Dowdeswell remarks, 'since it is competent for parties to make their contracts dependent upon any conditions which even caprice may suggest, whether the portion of a warranty eventually discovered to be incorrect or not complied with be material or wholly immaterial with respect to the nature of the risk, the result will be the same, and where the truth of the facts are positively alleged, and not limited to the knowledge of the assured, *although a misstatement may have arisen from the most innocent mistake, or from false information afforded by others, or mere inadvertence, the assured will be in the same position as to legal remedies in the contract as if he had made the most wilfully fraudulent averment*.'*

"Whenever a statement is embraced in a warranty, it must be proved to be strictly and literally true, whether material to the risk or not. Thus Lord Eldon, in moving the House of Peers, observes, "It is a first principle in the law of insurance, on all occasions, that where a representation is material, it must be complied with. If immaterial, that immateriality may be inquired into and shown; but that if there is a warranty, it is part of the contract that the matter is such as it is represented to be, *therefore the materiality or immateriality signifies nothing*. The only question is as to the mere fact.'†

* * * *

"The obvious effect of the preceding doctrine of law, when applied to life policies, *as these documents are now framed*, is that, although the Company have had the means of satisfying themselves, from medical examinations, reports, and other documents, and any other inquiry they may have chosen to make, that the life is insurable, and parties have for years regularly paid the premiums, the question whether there is an assurance or not, still remains open as against the assured, whose policy may at any future time be questioned upon the general ground that the life was not insurable at the time of effecting the assurance; or that the disclosure of the circumstances then made, was not complete; or that some fact, perhaps quite immaterial, contained in one or other of the several series of questions had turned out, on further inquiry, to be different from that warranted."

The writer then shows, by a large selection of well-authenticated cases, that the directors of companies—both proprietary and mutual, both old and new—have been by no means slow to avail themselves of the extraordinary degree of protection which the law has thrown around them—that much grievous hardship has been inflicted on families

* Dowdeswell on the Law of Fire and Life Insurance, page 35.

† Macmorran and Co., 10th July, 1815, 3 Dow. 225.

and individuals through the proneness of companies to contest policies on the most technical and trivial grounds, and the great difficulty of obtaining redress at their hands —and that the fears and apprehensions which have been thus spread abroad among the community, have probably done more than all other causes united, to retard the progress of life assurance.

The remedy proposed is, to make every policy, after it has been once granted, *indefeasible and indisputable.* Let every possible precaution be used before effecting a policy; but once effected, let it not be afterwards disputed on any ground whatever.

We think this is a proposition which will meet with very general approbation; and sure we are, that were it universally adopted by the offices, it would tend more to multiply the number of insurances than any other step which could be taken to accomplish that end.

To an objection made, that such a provision would lead to the encouragement of fraud, the writer makes the following satisfactory reply:—

"This brings the question to its true issue. Granting that policies may sometimes be fraudulently obtained, whether it is better—more fitted to give full scope and development to the manifold advantages of life assurance, that assurance companies should be tied down to a reliance upon their own care and vigilance in granting assurance,—that, instead of having permission to ask a jury to say, after a man is dead, whether his representations have been correct, they should be required to take sufficient pains to ascertain that fact for themselves while he is alive,—and that thus a policy of assurance should have an indefeasible stamp of value so affixed to it that it can be freely and safely used for all the purposes for which such a security can be made available; or that, in order to relieve companies from the necessity of exercising vigilance and caution in the taking of risks, or at least to protect them from the remote danger of such frauds as no vigilance will guard against, the value of every policy should be liable to depend upon the issue of an inquiry, to be conducted by the holder single-handed (in many cases a widow or infant family) against a powerful and wealthy association, possessing all the advantages which wealth gives over poverty in such a struggle.

"The question does not appear a difficult one to answer. Indeed, the answer has almost been given already. A policy of assurance, which does not make the holder sure of receiving the amount stipulated in it, is a contradiction in terms. The very object of the assurance is, that there may be no doubt as to the result. If there is to be risk after all, it would be better that each man should take the risk of his own life, and simply accumulate his savings. In all the uses which may be made of a policy of assurance—uses which are multiplying and extending every day—its value is injuriously affected by every doubt which can attach to its ultimate validity. This is, in fact, a fraud upon the assured. They pay for assurance, and they do not get it.

"The only objection to this is, that it would be unsafe for assurance companies to make their policies absolutely indisputable, that they would be subject to frauds which might seriously affect their stability. This objection would be fatal if well founded; for no system of assurance can be ultimately beneficial to the assured which is not safe to the assurers. But we are satisfied that the objection greatly overrates the danger. A company which knows that it is estopped from disputing a policy once granted, will, of course, take sufficient care to ascertain the real state of the risk before granting the policy. This, as experience proves, is not a matter of difficulty. All the facts regarding a man's present state of health and habits which it may be possible to prove before a jury ten or a dozen years hence, may, in the general case, be discovered on proper inquiry now; and a company which, knowing that a policy once granted can never afterwards be disputed, will use every possible precaution to secure that none shall be granted which they would have an interest to dispute. There is not the slightest reason to believe that the foundations of such a company are not, at least, as secure as those of any other company whatever."

To put the case even in the worst possible light—suppose the number of instances of fraud were to be multiplied under an indisputable system, fraud itself is a contingency which falls equally with life under the domain of the doctrine of probability—the degree of frequency with which it is likely to occur can be calculated—the pecuniary loss sustainable through it can be provided against (by a slight addition to the rate of insurance)—and whatever share of harm might result to the morals of society from

an instance now and then of successful fraud upon an assurance company, it would be more than ten times counterbalanced by the vast additional reliance which men would be induced to place on the saving virtue of provident and self-denying habits.

It nowise detracts, in our minds, from the authority of the pamphlet before us, that it is written avowedly with the view of recommending to public notice a new Life Policy Company, founded on the "Indisputable" system, which it advocates. It but serves to confirm our faith in the soundness of that system, to see that so respectable and influential a body of gentlemen as its direction is composed of, have associated together to carry it into practical effect. Of the success of this new company we entertain no manner of doubt—success both large and speedy. If it but thrive as it deserves, it will, ere many years, be one of the most thriving of all existing life-insurance companies—the survivor of not a few of the litigating fry of the present day, and the parent (we trust) of many other institutions, based on the same admirable principle of absolute certainty to the assured in all cases, and under all circumstances whatever.

SMITH'S YIELDING SEA-BARRIERS.

Sir,—Mr. T. Smith's remarks (*ante* p. 199), in reference to Smith's yielding barriers are perfectly just. His investigation supplies some obvious omissions in mine. He is quite correct when he observes, "It appears, therefore, to me, that this is the point at which the tension bar, B W, ought to be attached, and it may be shown that a higher or lower point would produce repercussion on the joint A, and be so much resistance, not only uselessly but mischievously expended." The impossibility of determining the point to which the tension rods should be attached, was the reason why I assumed two points from which to refer the moments of action.

The gangway along the top must be considered as an addition rather than a principal part of the structure, and in many cases would be serviceable; but as Mr. Smith observes, it would certainly, while the barrier was inclining over, tend to increase the strain on the tension rods.

I question, however, very much if, even in the roughest weather, the tension bars would be brought up very tight, or that they would ever be liable to be exposed to a maximum strain—the play of the frame being much greater than the drifting of any single wave. A vessel may drift with a single wave, perhaps, 10 feet. The frame would likewise drift only to that extent without any weights; the addition or accumulation of weight, as a matter of course, still further limits the action. If, therefore, the structure be allowed a play of 15 or 20 feet before the tension bars are brought into straight line, it follows that it is impossible to force the barrier to its greatest extent. The principal object of the tension lines will, therefore, be to bring the barrier back to its original position after the wave has passed over it.

I am, Sir, yours, &c.,

WILLIAM DREDGE.

London, 10, Norfolk-street, Strand, March 30, 1849.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING 12TH OF APRIL.

THOMAS METCALFE, High-street, Camden-town, Middlesex, gentleman. *For improvements in the construction of chairs, sofas, and other articles of furniture for sitting or reclining on.* Patent dated October 5th, 1848.

These improvements consist in the combination of two rectangular frames of metal, or other suitable material, which are of unequal sizes, so that the smaller one may be swivelled or hinged inside the other, and assume, when opened out to a certain distance, a form resembling somewhat an X, with the top half of one line broke away in the centre. A piece of any suitable flexible material is attached to the top portions of the large and small frames, so as to form the seat and back; while the bottom parts of both frames are connected together by a strap, whereby the inclination of the back may be varied at pleasure.

The patentee remarks, that by altering the shape of, and enlarging the frames, the chair may be converted into a sofa, or, by adding vertical supporters to the top portions of the frames, into a camp bedstead.

Claim.—The mode of combining the two frames and flexible piece into chairs, sofas, and other articles of furniture for sitting or reclining on.

Edward John Massey, Liverpool. *For improvements in apparatus for measuring the speed of vessels and streams, and for ascertaining the depths of water.* Patent dated October 5th, 1848.

This improved log consists of a vertical fan-wheel, which is partially inclosed within a case, rather more than semicircular in shape, and attached to the side of the vessel, beneath the water line. Upon the axle of the wheel is a crank attached to a piece of wire, which leads to the deck, and is connected at top to one end of a horizontal lever centred on a pin. The free end of the lever is furnished with a detent, projecting downwards, which is pressed inwards, by means of a spring, against the teeth of a ratchet wheel, which actuates a registering train of wheel work. Another spring is placed underneath the end of the lever connected to the wire, which, when the revolution of the fan-wheel has brought the crank uppermost, presses that end upwards and the detent downwards, whereby the toothed wheel will be caused to move one tooth round. The fan-wheel is made to revolve by the action of the water, during the passage of the vessel through it, upon those fans which project from beneath the case; and the speed is thus indicated and registered by a pointer on a dial, which is moved by the train of wheel work; the number of revolutions which the fan-wheel makes in a mile having been previously determined by a measured distance. Or, a pair of pallets may be substituted for the detent, which will allow a ratchet wheel to move one tooth round as the lever oscillates by the revolution of the crank. A tendency to rotate is communicated to the ratchet wheel by a train from a spring, as in the case of clocks. Or, the crank action may be communicated to the registering train of wheel work from an ordinary spiral rotator, by attaching its cord to an axle, (suspended in a bracket,) which is furnished, on the other side, with a crank, connected by a wire to the registering apparatus, as in the preceding case. The wire is enclosed within a tube fixed to the vessel's side, to protect it from injury.

The patentee next describes two modes of raising and lowering the log, by connecting it to a pitch chain worked by a toothed pinion on deck, or to an endless rope passing round two pulleys.

Either of these apparatuses may be employed to ascertain the velocity of streams, by maintaining it stationary in the current.

The improved sounding apparatus consists of a weighted case, containing a registering train of wheel work and a fan-wheel, some of the fans of which protrude partially from the side into the water. As the apparatus descends, the fan-wheel will revolve and actuate the train, whereby a pointer, moving over a dial fixed on the outside of the case, will indicate the distance travelled, or the depth it has fallen. The fan-wheel is prevented from moving in the reverse direction when drawn upwards, by means of a laterally projecting piece, which shields it from the water, and also catches in between the fans.

Claims.—The mode of combining in an apparatus a wheel, or spiral rotator, with a crank action, to give motion to a train of wheel work, for measuring the speed of vessels and of streams.

2. The means of raising and lowering the logs.

3. The combination of a wheel rotator and of wheel work, to ascertain the depths of water.

Joseph Sharp Bailey, Bradford, York, spinner. *For certain improvements in preparing, combing, and drawing wool, alpaca, mohair, and other fibrous materials.* Patent dated October 5th, 1848.

The heckling apparatus consist of a series of rollers—each alternate one being fitted on its periphery with points and bristles—into which the material is fed, by hand, through a pair of feeding rollers. The brush and porcupine rollers are made to revolve at a greater speed, and the points in the latter to decrease in length, size, and pitch, as their distances increase from the feeding rollers. Above the first porcupine roller and the last brush roller are suspended two plain rollers, which have the effect of increasing the grip of the porcupine roller and revolving comb frame upon the material as it is fed in, or taken off. This comb frame is placed in front of the last brush roller, and as each comb is successively brought opposite by the revolution of the frame, it is caused to project outwards, and its teeth to pass through the brush, and take off the material. When the combs are filled they are removed by hand.

The combing-machine consists of two vertical spindles, each carrying at top and bottom a number of radial arms which support the comb frames. The course of the revolutions of the latter, is determined by friction rollers travelling in guide grooves, which are cam-shaped, the irregular or entering portions being in parallel opposite planes, and one on either side of a horizontal right line drawn through the centres of the vertical axes. A differential speed is imparted to the spindles by means of toothed gearing from a prime mover, so that the comb frames shall revolve in opposite directions, the material be transferred from one set to the other, the sets of combs be made to recede from each other at a greater angle

to their faces than has hitherto been usual, and commence working at a distance apart, which decreases as the operation proceeds, so that the long fibres may be first combed.

The apparatus for drawing the combed material into slivers consist of a framework, carrying two horizontal fluted rollers, the upper one of which has additional longitudinal grooves in its flutes. Between the rollers passes an endless band of vulcanized india-rubber, or any material faced with vulcanized india-rubber, by which the wool, &c., as it is drawn out in slivers by the rollers, is carried away. The comb, charged with wool, is supported in front of the rollers, and has a variable traversing motion imparted to it, while a cleaning comb is interposed between it and the rollers, to intercept any knot which may be in the wool. When the holding comb has arrived in front of the rollers, it frees itself from the onward impulse which has been imparted to it, and returns to its first position, when it is removed, and a fresh one, charged with wool, substituted in its stead.

Lastly: the patentee proposes to heat the combs employed in combing wool, &c., by placing them in cases, to which hot air or steam is applied externally, without being allowed to come in contact with the teeth.

Claim 1.—The construction and arrangement of apparatus for preparing wool, alpaca, mohair, and other fibrous materials for combing, in which the rollers employed for that purpose are made to revolve at increasing velocities, and the points and bristles with which their peripheries are covered to decrease in length, thickness, and pitch, in proportion as their distances from the feeding end of the machine increase. And also in which the wool or other material is charged from the last brush-roller on to combs, by means of a revolving frame on which the combs are fixed.

2. The wool-combing apparatus, in which the revolving frames, or radial arms, carrying the combs are made to revolve in opposite directions, and at different velocities, so as to cause the combs to approach each other as described.

3. The apparatus for drawing the combed wool into slivers, in which the holding comb is made to approach the drawing rollers at right angles to them, and at a varying speed, by means of a traversing lever, the interposition of a cleaning comb between the holding comb and the rollers, the employment of auxiliary grooved fluted drawing rollers, and of an endless band, passing between them, of vulcanized india-rubber, or of any suitable material coated with vulcanized india-rubber.

4. The employment in combing wool and other fibrous materials of combs heated by the application of steam or hot air.

JOHN WRIGHT, Camberwell, Surrey, engineer. *For improvements in generating steam and evaporating fluids.* Patent dated October 12, 1848.

These improvements consist in the construction and application of tubes and cellular vessels, charged with water or other fluid, to the heating and evaporation of fluids; and the principle on which they are based, is the circulation of water through a coil of pipes, provided one portion of the coil is subjected to the action of heat. The mode shown by the patentee of applying tubes to this purpose, is by uniting the two ends of a sufficient length of metal tubing by a steam and water-tight joint, and bending it into a rectangular figure. One of the sides is then inserted in the furnace, and the opposite end is immersed in the water of the boiler. The water in the tube in contact with the fire will ascend by inferior gravity, and pass through the water in the boiler, to which it transmits a portion of its caloric, and descends to its first position, and thus becomes alternately a receiver and transmitter of heat. In order to its more effectual working, the two ends of the endless tube, in contact with the fire and the water, are made serpentine.

The cellular vessels are composed of malleable cast iron or copper, or any alloy of copper, cast in the shape of transverse tubes (with spaces between them), which open into longitudinal tubes. Or, they may be made of two corrugated metal plates, united by welding or by riveting. One of the vessels is placed underneath the boiler in the furnace, and other vessels are immersed in the water of the boiler, and all connected by water and steam-tight joints, and filled with water. The heat, ascending from the fuel, strikes against the cellular vessels, and, passing through the spaces between the first part of the transverse tubes, impinges against the bottom of the boiler. It then passes over the bridge, and descends through the spaces of the second part into the flues, whence it escapes to the chimney. The vessels, before being used, are bent into a curved shape. In locomotive and marine engines, the transverse tubes are placed vertically, and may be used to form the sides of the furnace of the former. In marine engines, and in cases where no great body of fluid is to be operated on, one of the vessels is placed out of the boiler, and the feed water or fluid to be evaporated caused to fall upon it in minutely divided particles, like spray. To the back of the descending portion of the vessel is affixed a tube, connected with a safety valve, loaded, to allow

of the expansion of the water. Any loss of water in the vessel from contraction, is supplied by an ordinary self-feeding apparatus.

Instead of water, it is proposed to employ, as the transmitting medium of caloric, eoline or oleaginous oil, or amalgam of mercury.

Claims.—1. The various cellular vessels, charged with water or other fluid, for boiling or evaporating liquids.

2. The use of cellular vessels, charged with water or other fluid, for boiling or evaporating liquids when employed as described—that is to say, when one or more vessels are immersed in the liquid to be boiled or evaporated, and connected to one or more vessels placed in the furnace.

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal.*]

For an Improvement in Registers for Furnaces. *George Pollock.* This improvement consists in hanging the valves on journals in the middle, so that each valve shall be balanced, or nearly so, when this is combined with the arrangement for opening and closing them, which consists in having two pins projecting from the upper surface of each valve, and perpendicular thereto, and acted upon by a cam-formed rim attached to the vertical spindle, this rim being so formed that as it recedes from the axis of the spindle, it rises to a plane oblique to the axis. By this arrangement the cam rims are embraced by their appropriate sets of pins, so that when the spindle is turned in the direction from the point of the greatest diameter of the cam rim towards the shortest diameter, the two valves are turned from a plane at right angles, or nearly so, with the spindle, to a plane parallel therewith, and vice versâ.

Claim.—Hanging the valves, or journals, in the middle of the width to be balanced, substantially as described, when this is combined with the cam-formed and oblique or curved rims, by means of the pins projecting from the surface of the valves, and at right angles thereto, or nearly so, as set forth.

For an Improvement in Decomposing Alkalies and other Salts. *R. A. Tilghman.*

Claim.—Decomposing the sulphates of baryta, strontia, lime, and magnesia, and the muriates of baryta, strontia, and lime, by exposing them at a high temperature to the action of a current of steam, for the purpose of obtaining the acids and the alkalies of these salts respectively. And the decomposing the sulphates and muriates of potash and soda, for the purpose of obtaining the acids and the alkalies of these salts respectively, by exposing them at a high temperature to the action of a current of steam, alumina, or other combining substance being present. And also making aluminates of potash and soda, by the action of a current of steam upon a mixture of alumina and the sulphate or muriate of potash or soda, at a high red heat. And making sulphate of soda by the action of a current of steam upon the muriate of soda at a red heat, sulphate of lime being present, as described.

For an Improvement in Decomposing Potash Felspar for obtaining certain Salts. *R. A. Tilghman.*

Claim. — The method of decomposing potash felspars for the production of sulphate of potash, by heating at or above redness, a mixture of potash felspar, and the sulphate of either lime, baryta, or strontia. And the method of decomposing potash felspars for the production of muriate of potash by heating together a potash felspar and the muriate of either soda, lime, or iron, at a temperature above the melting point of the muriate employed.

For an Improvement in the Construction of Boats and other Vessels. *Joseph Tuers.*

The nature of this improvement consists in forming a boat with a single bow, from which diverge two keels, the triangular space between said keels being occupied by an inclined plane that extends from a point just in the rear of the bow, backward, and upward to the transom, where it terminates, and at which point it is as broad as the space between the keels; by which means a boat is obtained possessing in all essential particulars, the advantage of a double or turn boat, and obviating many of its prominent defects.

Claim.—The combination of a single bow with two diverging keels, and in combination therewith, the inclined centre plane.

For an Improvement in Dragoon Saddle-trees. *Thornton Grimsley.*

This invention consists of an improvement upon the form of the pommel and cantle, made use of in the construction of the French, or old dragoon regulation saddle-tree, and in the combination, without metallic fastenings, of the French huzzar, or dragoon regulation style of pommel and cantle, or improved form of pommel and cantle, with winding side bars, of such a form, and arranged in such a manner, that they will bear so equally and uniformly in every part, upon the back of a horse or mule, as to require no padding. The French huzzar saddle-tree has straight side bars, which do not fit the back of the horse with accuracy, and in consequence, it is necessary that

they should be padded to prevent injury to the horse. The pommel and cantle are secured to the side bars of my military saddle-tree by means of a raw hide covering, confined in the manner set forth, by which means this tree is much lighter and stronger than the French huzzar tree.

Claim.—The form of the improved side bars, the under side of which are adapted to the form of a horse, and the upper side and edges to the seat of the rider, and the combining and securing the same to a high pommel and cantle, by means of a raw hide covering, substantially as set forth.

FOR AN IMPROVEMENT IN MACHINERY FOR GRINDING KNIVES WHICH HAVE WARPED SURFACES. *William Hovey.*

Claim.—The application of the grinding wheel, so mechanically arranged that, while the grinder is made to revolve longitudinally on the edge of the knife, it receives at the same time a lateral reciprocating motion on its own axis, which is at right angles with the line of the edge of the knife on the cylinder, or nearly so; in combination with the top and bottom traversing carriages and the gauge rest.

FOR AN IMPROVEMENT IN GALVANIC BATTERIES FOR TELEGRAPHS. *L. B. Swan.*

Claim.—The use of a particular solution when applied to the batteries of the electro-magnetic telegraph; said solution consisting of dilute sulphuric acid, kept saturated by an alkaline sulphate, for the purpose and in the manner herein fully made known. I limit my claim to the use of the solution in batteries used for telegraphic purposes, and this I have done, that I may not be supposed in any way to interfere with experiments having for their object the advancement of science.

FOR AN IMPROVEMENT IN FENCES. *W. G. Brainard.*

Claim.—The application of the lever and fulcrum principle, in building and supporting on the surface of the ground, post and bar or rail fence; the said principle to be applied in the following manner:—After fastening the first post permanently, insert in the mortises of said post any desired number of bars or rails, say from three to six; then place a second post on the opposite ends of the bars or rails, carrying said second post, with bars inserted, round in a perpendicular position, say to the right of the intended line of fence, so far as to make the bars operate as levers on the first post. Then insert a second set of bars or rails in the same mortises with the first set of bars, the tenons of one set above the others in the second post, placing a third post on the opposite ends of the second set of bars, carrying the third post to the left of said intended line, to such an angle as to make the second set of bars operate as levers on the second post, proceeding in the same manner, carrying each succeeding post, with bars inserted, each way from the intended line of fence, far enough to bind the bars and posts firmly together, supporting each set of rails together with the posts, firmly in their perpendicular position, fastening the last post as the first firmly in its place; all the other posts being placed on the surface of the ground.

Employment of Asphaltum as Fuel.—Admiral, the Earl of Dundonald, who is now Commander-in-chief on the American station, addressed lately a letter to Lord Harris, the Governor of Trinidad, on the subject of some experiments which have been made on board the *Scourge* steamer with asphaltum of the celebrated pitch lake of Trinidad as fuel for generating steam. His lordship reports that the bitumen has been mixed with coals in the proportion of two parts to one of coals, and had succeeded in generating steam in sufficient quantity. Lord Dundonald is stated to have submitted an ingenious plan of a furnace adapted to the burning of the asphaltum, and urged that the use of such fuel in the sugarworks of Trinidad would effect an economy in the manufacture of the staple which would be highly beneficial to the island.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subject of Design.
April 4	1836	George Carrington	Birmingham	Wedding-ring strainer.
5	1837	John Howard and Son	Bedford	Horse drag-rake.
7	1838	Stephen Hartley	Chelsea	Artificial bird-shooting machine.
10	1839	Michael James Brown,	Oundle	Tile and pipe machine.
,,	1840	Bryan Donkin, and Co.,	Bermondsey	Cock for water, steam, gas, &c.
11	1841	George White	Jersey	Chimney-pot or ventilator.
12	1842	Thomas Walker	Birmingham	Rotating heel for boots and shoes.

No English Patents sealed this week.

Advertisements.

GUTTA PERCHA
PATENTEES, WHARF ROAD, CITY ROAD, LONDON.
COMPANY.

Wharf Road, City Road, London.

IT cannot now be doubted even by the most sceptical, but that GUTTA PERCHA must henceforward be regarded as one of the blessings of a gracious Providence, inasmuch as it affords a sure and certain protection from cold and damp feet, and thus tends to protect the body from disease and premature death. Gutta Percha Soles keep the feet WARM IN COLD, AND DRY IN WET WEATHER. They are much more durable than leather, and also cheaper. These soles may be steeped for MONTHS TOGETHER in cold water, and when taken out will be found as firm and dry as when first put in.

Gutta Percha Tubing,

Being so extraordinary a conductor of sound, is used as speaking tubes in mines, manufactories, hotels, warehouses, &c. This tubing may also be applied in Churches and Chapels, for the purpose of enabling deaf persons to listen to the sermon, &c. For conveying messages from one room to another, or from the mast-head to the deck of a vessel, it is invaluable. For greater distances the newly-invented Electric Telegraph Wire covered with Gutta Percha is strongly recommended.

Mill Bands.

The increasing demand for the Gutta Percha strapping for driving-bands, lathe-straps, &c., fully justifies the strong recommendations they have everywhere received.

Gutta Percha Pump Buckets, Clacks, &c.

Few applications of Gutta Percha appear likely to be of such extensive use to manufacturers, engineers, &c., as the substitution of it for leather in pump buckets, valves, &c. These buckets can be had of any size or thickness WITHOUT SEAM OR JOINT; and as *cold water will never soften them*, they seldom need any repair.

Gutta Percha Picture Frames.

The Gutta Percha Company having supplied HER MAJESTY THE QUEEN with several elaborate Gutta Percha Picture Frames for Buckingham Palace, which have been highly approved by the Royal Family, fully anticipate a great demand for frames from the nobility throughout the country. In order that the picture-frame makers may not be injured, the Company will supply the trade with the mouldings, corner and centre pieces, &c., and allow them to MAKE UP the frames. Pattern books for the trade are now ready.

Gutta Percha soles, solution, inkstands, card-trays, medallions, picture-frames, brackets, mouldings, window-blind cord, soap-dishes, tap-ferrules, cornices, vases, fire-buckets, bowls, pen-trays, stethoscopes, thin lining, thread, flower-pots, ear-trumpets, &c., &c., manufactured at the Company's Works, Wharf-road, City-road, London; and sold by their Wholesale dealers in town or country.

Neuber's Improved Liquid Glue,

Impervious to DAMP or HEAT, perfectly free from smell, and ready for immediate use.

FOR WOOD, METAL, STONE, MARBLE, IVORY, SLATE, GLASS, CHINA and EARTHENWARE, Plaster Models, Paper and Pasteboard, and various other purposes, this cement will be found a most invaluable acquisition. Sold by all Chemists, Oil and Colourmen, Stationers, &c.; and also at the Patentees, Messrs. NEUBER and WATKINS, Varnish and Japan Manufacturers, 549, New Oxford-street, and 76, Long Acre; where samples may be obtained, or forwarded, free, on receipt of 12 postage stamps. Price, Pale, 12s., Dark 8s. per gallon; and in Bottles at 6d., 1s., and 1s. 6d.

All Letters, Orders, &c., to be directed to 549, New-Oxford-street.

EXTRACTS FROM THE LONDON PRESS.

"For repairing anything short of a 'kingdom out of joint,' or 'a broken constitution,' this Improved Liquid Glue seems quite up to the mark. We have tried it on a China dish, a wooden box, and a meerschaum pipe, with equally satisfactory results."—Vide *Builder*, Dec. 30, 1848.

"It will not mix with water, is consequently impervious to moisture, and remains quite unaffected in damp situations. It is incombustible, free from the slightest smell, dries quickly after a joint is made with it, and its adhesiveness and tenacity are, under most circumstances, superior to the common glue.—Vide *Mining Journal*, December 9, 1848.

Erratum.—Page 243, col. 1, line 27, for "*three-sixteenths* of an inch thickness," read "three *thirty seconds*," &c.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

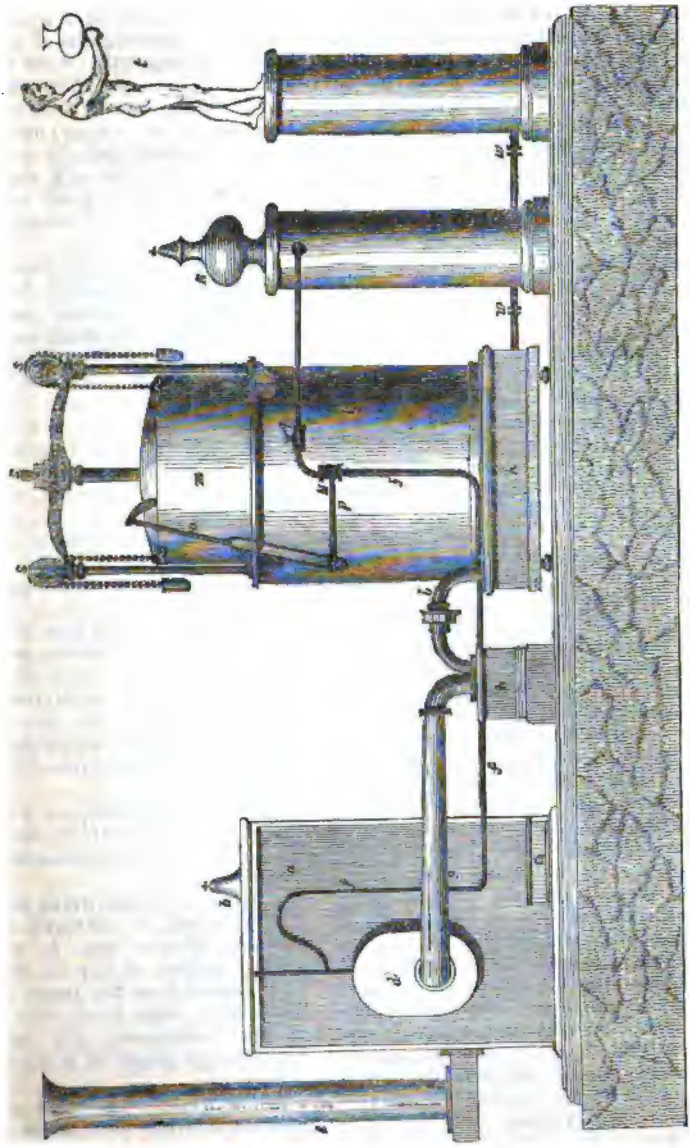
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1341.] SATURDAY, APRIL 21, 1849. [Price 3*d*, Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

PATENT CAMPHINE GAS APPARATUS.

Fig. 1.



PATENT CAMPHINE GAS APPARATUS.

The accompanying engravings represent an apparatus for the manufacture of gas for illuminating purposes, from English's patent camphine oil, which has been for some time in use at the Harrow Station of the North Western Railway. We had last week the pleasure of personally inspecting it while in operation, and are induced to bring it thus prominently under the notice of our readers because it seems to us to possess advantages which render it better adapted than any yet offered to the public for all places where (as at secondary railway stations, such as Harrow,) a considerable number of lights are wanted, and where no public coal gas works are at hand from which a supply can be obtained; and in many cases even where coal gas is to be had both conveniently and cheap.

To speak *firstly* of the quality of the light—the chief point of course to be considered—this is such as no coal gas that we have seen can compete with in point of splendour and diffusiveness. Camphine gas bears the same relation in this respect to other illuminating gases which the camphine itself bears to other oils. At the Harrow Station a single jet of not more than a quarter of an inch in diameter, casts from the signal post a strong light along the line, for several hundred yards on either side. Certainly there is no other station on the line having an equal number of burners, which is half so well illuminated.

Secondly. The gas is exceedingly pure—wholly free from the sulphurous and other deleterious intermixtures, with which all coal gas is more or less contaminated, and though smelling very slightly of naphtha, yet not so much so as to be at all disagreeable. For out of door purposes this exceeding purity is of small moment, but in inclosed places where numbers of people congregate, as churches, factories, barracks, warehouses, &c., and in the abodes of the rich and luxurious—the "gilded hall and mirrored saloon"—a gas that will illuminate without either vitiating the atmosphere, or tarnishing furniture and hangings by carbonaceous and sulphurous deposits, is a thing of the first consequence and sure to be universally prized.

Thirdly. The camphine gas, though so much better than coal gas, may be produced by means of an apparatus such as we are about to describe, at as low a price as the latter is now commonly supplied to the public. A flame of this gas, equal to 5 cubic feet of ordinary coal gas, can be maintained at a cost of from a farthing to three-eighths of a penny per hour. Consequently, when coal gas is at from 5s. to 6s. per 1000 cubic feet, the two gases may be said to be in respect of cost (though in no other) on a par.

And, *fourthly*, the apparatus occupies a very small space—is simple in its construction, to a great extent self-acting; and is withal entirely free from danger.

The apparatus at the Harrow station, occupying but a few square feet—a small closet apart—generates gas sufficient for the current consumption of twenty burners. And strange to say, the gas-holder contains at no one time more than about 15 cubic feet of gas. How this is accomplished we shall now proceed to explain with the help of the engravings; fig. 1, of which is an elevation of the entire apparatus, and fig. 2, a section of the furnace and retort.

a is the furnace, which is constructed of iron lined with fire-brick, and filled from the top through the hopper, *b*.

c, ash pan.

d, the retort, which is set horizontally at one end of the furnace, and divided from the fuel by a fire-brick partition, in the lower part of which there are flue holes, *f f*, (fig. 2,) for the flame and gaseous products of the furnace to pass through and circulate round the retort.

e, the chimney.

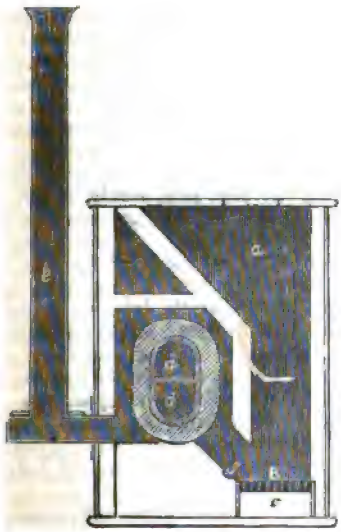
f (fig. 1) a pipe through which oil is supplied to the retort from the reservoir, R; and N, *o p*, a self-regulating tap and levers.

g, a pipe, through which the gas, as first generated, is conveyed to a small cast-iron syphon box, *h*, where the greater portion of any oil which may have escaped from the retort in an undecomposed state along with the gas, becomes condensed, and falls down, while the gas passes off at top through a pipe, *i*, to

k, the washer, where the gas undergoes a still further purification, and from which it ascends through a refrigerator

placed in the tank, *l*, of the gas-holder, *m*. S, S, S, are the suspenders and balance-weights.

Fig. 2.



And *w* is an outlet pipe, through which the gas flows freely to the different burners of the station, and also to the burner, *t*, by which the gas-room or closet is itself lighted.

The part played in these arrangements by the self-regulating tap and levers, N, *o p*, is particularly deserving of observation; it forms, in fact, the main feature of the whole invention. As the gasholder becomes filled, it causes, by its ascent, the tap, N, to be closed through the medium of the levers, *o p*, and as it empties itself it causes, by its descent, the tap to re-open, and thereby to admit a fresh supply of oil to the retort, to be there converted into gas to make up for that which has been consumed. And hence the generation and consumption of gas are always kept in a precise ratio to one another, and a very small gas-holder is made capable of supplying a very large number of lights. The gas, in fact, is only made as wanted, and exactly in the quantity wanted. Hence, also, a great saving of labour and attendance. The chief thing the attendant has to do is to keep the furnace supplied from time to time (say twice or thrice a day) with fuel (and not much of that), and to turn the discharge tap, *q*, when it is required to let on the oil to the retort. Supposing the oil reservoirs to be filled each day with sufficient for the day's consumption, the apparatus will of itself do all the rest.

We have seen, at the manufactory of Messrs. Crosley, Son, and Galsworthy, Emerson-street, Southwark, another apparatus of this kind, constructed for a gentleman's marine villa, which is somewhat different from that which we have just described, but not sufficiently so as to make any separate description of it necessary. We mention it here only for the sake of pointing out to gentlemen who may be desirous of testing the justice of our recommendation by an actual inspection of their own, which they may do without the trouble of going to Harrow.

ON WIRE GAUZE LAMPS; THEIR SUITABILITY FOR CERTAIN PURPOSES TO WHICH THEY HAVE NEVER YET BEEN APPLIED.

Sir,—The perusal of Mr. W. Baddeley's very useful and interesting report of the "London Fires in 1848," in No. 1336 of your Magazine, has suggested to me that the use of wire gauze lamps in certain cases would have prevented about 100 fires. I will presently particularize those cases, and give some hints which I believe will be found useful to your readers and their friends. In my opinion, it is the duty of every one who has discovered a remedy for any great calamity, to communicate that remedy for the benefit of his fellow-creatures; and therefore I have confidence in sending you these remarks for publication. Prevention of destructive fires is an important consideration; consequently, I shall not consider my time wasted while writing this letter, since its purport is to make known very easy and effective means of avoiding the conditions necessary for causing ignition in certain cases.

In Mr. Baddeley's report it is stated, in the list of causes of fires, that 61 occurred from ignition of the bed curtains by candles; 39 from explosion of the gas emitted from defective fittings; and 1 from sewing in bed. Although not particularly noted, I think it may safely be assumed that a large proportion of the 61 cases were caused by the cur-

tains catching fire when reading in bed with a candle. However that may be, it is a very common custom. The 39 fires were doubtless directly caused by the introduction of a naked candle into the escaped gas, which was rendered explosive by admixture with atmospheric air. The one solitary case should have been classed with the 61, because that fire was not directly caused by sewing in bed, but by the bed furniture catching fire. In every one of these 101 cases all injurious consequences might have been avoided, if wire gauze lamps had been used instead of candles. I suggest, therefore, that for perfect security all night lamps should be protected by wire gauze. From numerous experiments with gauze lamps, I am enabled confidently to affirm that the safest night lamp is a wire gauze lamp: it may be composed of wire gauze alone, or it may be a combination of glass and wire gauze; but it is equally safe in either case. Its configuration may be infinitely varied, because there is not the same strict necessity for careful construction as in colliery lamps, where the slightest defect might sacrifice scores of lives. If wire gauze lamps were used pretty generally in bed-rooms, fewer fires would be caused. Several persons have admitted to me that my cylinder lamp would make a capital night lamp, as it will neither communicate fire nor allow any sparks to escape; and one gentleman told me that he considered it quite safe even when suspended to the bed curtains.* There need be no apprehension of the wire gauze being heated sufficiently to ignite any combustible by mere contact; because, if properly constructed, the metal will never be made red-hot unless immersed in gas, which can never be the case in bed-rooms.

I am also enabled to say that wire gauze lamps are as incapable of igniting coal gas, or any other gas, as of igniting the carburetted hydrogen found in coal-pits. Such lamps can, therefore, be taken with perfect safety into a room, whenever it is discovered that the gas has escaped. Accidents are so often occurring in this town and others from the escape of gas, that I think it would be well for all parties who use gas to be provided with one wire gauze lamp to be used on emergency. And, likewise, it seems expedient that gas-fitters should be provided with such lamps, as they are often summoned to repair the fittings in cases when gas has escaped, and where the occupiers dare not enter the gaseous apartment. The expense individually would be trifling; and if 39 fires could have been prevented in London alone during the past year, surely it will be admitted that my recommendations deserve some attention. When it is perceived by the olfactory nerves that gas has escaped in any building, no person should rush instantly into the midst of it with a naked light; but the wire gauze lamp should be lighted and taken into the apartment to discover the leak, which must be immediately stopped, and the room well-ventilated by opening doors and windows, and, if necessary, by creating a current of air by means of bellows to drive out the gas.

There are other times and occasions when gauze lamps might be advantageously used; as, for example, in gunpowder magazines and in chemical laboratories; but those enumerated above are the most urgent and apparent. To thoughtful persons the proper time for using these lamps will always be evident; and it is to be hoped that as no one would calmly and wilfully fire his dwelling, so they will always take proper measures for preventing such terrific disasters.

I am, Sir, yours, &c.,
JOHN CRANE.

26, Cannon-street, Birmingham,
April 13, 1849.

* Our correspondent refers to a miner's lamp of his invention, a model of which he sent us a short time ago. We did not publish any account of it, because it did not appear to us to possess any advantage over the Davy or Clanny; but we think it might be usefully employed in such cases as those pointed out in this letter.—ED. M. M.

RAILWAY RATING.

Sir,—I had felt some disappointment, that my paper, in No. 1317, had not elicited any information from your correspondents, as to the defective point which required to be supplied by some party in possession of the necessary facts. Nor has that disappointment been removed by the letter of *Mr. Lomax*, which has just come under my eye, because it should seem that I have entirely failed in making myself understood, at least by *him*.

I have not disputed, but on the contrary, I uphold, his doctrine, that railways are to be rated upon the same principle as "dwelling-houses, warehouses, cotton and other mills, bleach-works," &c. And equally mistaken is the idea, that I support a mileage division of the whole rateable value. Such a division has often been contended for; nay, has been made and submitted to—but only upon the principle of *cutting* the knot, because no means were provided for *untying* it.

The point to which my paper tended was this, that in determining the rateable value of a separate portion of a railway, it was practicable to obtain the gross *receipts* belonging to that portion; but the difficulty was, the apportionment of *expenses*. To take them at a per centage upon the receipts would leave too high a rateable value for the portions of little traffic; and too low for the portions of great traffic; and on the other hand, if the working expenses were to be distributed upon the mileage principle, the effect would be reversed. Therefore, I have laid it down, that the working expenses are to be apportioned *partly* upon the one principle and *partly* upon the other. Give a definite meaning to this indefinite phrase "*partly*," and my difficulty is surmounted.

I have known it argued, that each element of profit is rateable *fully* in the parish in which it arises, and yet that adjoining parishes are entitled in some degree to include it in their estimate of rating, through the benefit communicated from one parish to another in the necessary use of the railway. It is obvious, that the rateable values in each parish, if framed in this way, and then added together, would collectively exceed the rate that could be imposed on the whole railway, were it comprised all in one parish. And therefore, I placed in front of my array, the article which startled your correspondent. But I believe the truth of it cannot be gainsaid. Nor will Mr. Lomax do so, when he entirely comprehends its meaning.

On one point I quite differ from Mr. L., in treating the amount of *money expended* upon railway works as an element to be regarded in the assessment, for this reason. The cost of any work put upon the land can only be used as a means of determining the annual value, in ordinary cases, where not a shilling has been expended, but with direct reference to production of rental. But large sums may be expended without the possibility of any return in the shape of occupation rent. Take for instance, the Nelson Column. If that belonged to an individual, could there be found a person who would give him a shilling for it as rent? It could not therefore be rated. Now, the expenditure upon most railways has partaken, more or less, of this unprofitable character, and therefore it cannot be relied upon as an element in deducing the annual value.

I am, &c.,

J. W. WOOLLGAR.

Lewes, April 14, 1849.

ELECTRIC CLOCKS.—MR. APPOLD'S ALLEGED IMPROVEMENTS.

Sir,—I shall feel obliged if you can find a place in your next Number for a few remarks upon the letter of Mr. Holmes, which appeared in No. 1384 of your Magazine, relative to an alleged improvement in electric clocks, by Mr. Appold. If Mr. Holmes had taken the trouble to look at the specification of my patent of 1845, or of examining any of my electric clocks that are now going, he would have seen, that I have already provided a *self-adjusting compensation*, and that the pendulum *does not*, in any of my electric clocks, receive a portion of the electric current, during *every vibration*. The pendulums of all my electric clocks, of which there are many going most satisfactorily in England and Scotland, receive their electric power only when the pendulum vibrates within certain assigned limits; and this was the case in Mr. Appold's clock *as sold to him*. The instant the vibrations of the pendulum increase beyond the prescribed limit, the electric current is cut off, and is not let on again until the vibrations are reduced to the proper standard. This, too, is accomplished in the most simple manner, and without any increase of mechanical action, and the adjustment to any desired rate of vibration is so easily effected, that I must be permitted to doubt if the regulation of the supply of electric power to clocks, can be farther improved. With respect to the "retarding forces," mentioned by Mr. Holmes, all persons acquainted with electro-mag-

netism are, I apprehend, aware that every electro-magnetic instrument is also, of necessity, a magneto-electric machine—especially where permanent magnets are employed. When a current of electricity is passed through the wire, it disturbs the magnetism of the steel, and this is the power that works the clocks. If a *magnet* is passed through the coil, it excites *electricity* in the wire, and if the magnet and coil are tolerably powerful, the current, thus excited, will of itself work a clock; being sufficient to keep a pendulum in motion, considerably heavier than the coil which produced the current. From this it will be apparent, that were it not for the "retarding force," we should have herein realized the long-sought-for *perpetual motion*. I have often attached two electric pendulums, so that the coils of both formed one complete circuit of insulated wire, but without any voltaic apparatus or other source of electricity being present except the pendulums themselves. I have sometimes placed the two pendulums in separate rooms at a considerable distance from each other; on causing one of the pendulums to vibrate, by hand, before I had time to walk into the other room, the other pendulum would begin to move and keep on gradually increasing its vibrations until they were nearly as great as those of the first pendulum. In this case, the pendulum moved by hand became the source of power; magneto-electric currents were induced by the coil passing over the magnets, and as these induced currents passed through the coil of the quiescent pendulum they acted in the same manner as voltaic currents would have done, and set it in motion.

I have frequently worked *companion clocks* by these currents, and in one respect they are better for the purpose than voltaic currents, which require the circuit to be made and broken, while the former continues complete. This mode of operating is secured by my patent of 1847, as may be seen on examining my specification at the Enrolment Office.

I do not consider that these magneto-electric currents interfere with the time of the electric clocks, because they are uniform and constant, except the trifling decrease that may take place in consequence of the magnets losing a portion of their power, but even this takes place very slowly, and always gradually.

With respect to the assertion of Mr. Holmes, "that it can hardly be said that the invention of electric clocks has been productive of any real advantage," I beg to say, that a number of my electric clocks have been in action for the last five years, giving great satisfaction to their possessors; and if it had not been that my whole attention, for the last two or three years, has been fully occupied with my electro-telegraphic inventions, the electric clocks would have been much more extensively introduced. I hope in a very short time to be enabled to make up for past neglect, and do ample justice to this very valuable invention.

I remain, Sir, yours truly,

ALEX. BAIN.

Beevor-lodge, Hammersmith, April 11, 1849.

DAVIES'S ROTARY ENGINE.

Sir,—In my reply to Mr. Dredge's letter in the *Mech. Mag.* of this day, I shall endeavour to imitate his brevity.

Upon the subject of *dead points* I have nothing to add to my former remarks—but am content to leave the matter as it stands to the judgment of your readers.

As Mr. Dredge seems to have mistaken my meaning in what I wrote relative to the necessity of a fly-wheel, I will put it in a different way. A reciprocating engine may be started without the aid of a fly-wheel if the crank be placed 15°, or, to avoid all dispute, say 30°, beyond the line of centres; but Davies's engine could not be started until the piston be 60° beyond the line of centres. Now, in the reciprocating engine, the piston would have moved through only about one-fifteenth part of its stroke, whilst the crank moved through 30° from the line of centres, and consequently, it would require the assistance of the crank through one-fifteenth only of the stroke to carry the crank past the line of centres, but the piston of the rotary engine will require the aid of the crank through one-sixth of its stroke to carry it past the line of centres.

As to the question of cost—I would merely ask, is the rotary engine sold by weight?

The meaning of the paragraph which Mr. Dredge deems vague and contradictory is simply this—that in other rotary engines, the main object, the production

of a rotary motion of a shaft by the continuous action of the steam alone, without the aid of a fly-wheel, has been before achieved in various ways, but that the great objection to them was the difficulty of keeping the packing steam tight. In Davies's engine this difficulty appears to be in a great measure obviated, but then he has missed the *essential point* of a rotary engine—viz., the rotary motion of the shaft by the action of the steam alone. Hoping this explanation will suffice to reconcile the supposed discrepancies. I remain, Sir, yours, &c.

A. Z.

April 14 1849.

CASE IN GENERATING STEAM.

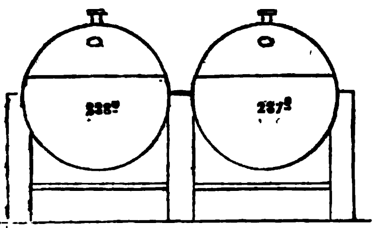
Sir,—The following case, in continuation of the one submitted in your Magazine of 24th February, with an opinion from a scientific gentleman, and a few remarks by a third party, may not be uninteresting to some of your readers, and possibly will elicit a further investigation of the subject through the medium of your columns. May I ask the favour of its insertion?

F. B. O.

Case.

A constant supply of heat of 238 degrees is given into the boiler No. 1, and a similar supply of 231 degrees into No. 2, each generating 50 measures of steam in a minute, the one of 9 lbs. and the other of 6 lbs. to the square inch.

No. 1. No. 2.



1st. Let it be supposed that a stream of cold water is made to pass through a pipe in the steam chamber of No. 1, which shall constantly abstract 7 degrees of heat, will not the evaporation of water in that boiler be thereby reduced to that of No. 2—namely, about 34 measures, instead of 50 of 9 lbs. to the inch, which, expanded into 50 measures, would be of 6 lbs., and will not the temperature both of water and steam remain the same—namely, 238 degrees?

2nd. Suppose a red-hot bar of iron thrust into the pipe of No. 2, communicating a constant increment of heat of 7 degrees. Will not the evaporation in that boiler be accelerated, and will not the extra heat be taken up by the steam without raising the temperature of the water, except at the surface?

3rd. Suppose, instead of the red-hot iron, the steam from No. 1 be carried through the pipe of No. 2, in such a manner as to give a constant addition into the steam chamber of 3½ degrees, abstracting, of course, 3½ from the supply of No. 1. Will not this reduce the evaporation of No. 1 from 50 measures to about 42, which, expanded, would give 50 of 7½ lbs?

4th. Would the case be altered if, instead of an intervening pipe, the steam from the two boilers be made to mix freely together, and escape through a safety valve loaded with 7½ lbs.?

Answer by an Engineer.

I admit that the produce of steam in boiler No. 1 may be reduced to that of No. 2, if a current of cold water is made to pass through its steam chamber; but the consequent decrease of 7 degrees in the temperature, means nothing else but that 50 measures of steam, of 3 lbs. pressure to the square inch, are condensed in a minute. Whenever this decrease of pressure is effected, violent ebullition will take place until the temperature of the water is also reduced to 231 degrees.

Remarks.—There can be no *condensation*, as the term is generally understood—that is, a reduction of steam into water, under the temperature of 231 degrees. The whole steam generated might be *reduced* from 9 lbs. to 6 lbs. pressure. But in this case even, there can be no reduction. 238 degrees of heat are constantly given from the furnace, 26 degrees above the point of ebullition, of which 7 degrees are absorbed by the pipe, and 19 degrees carried off by steam, which, passing through a safety valve loaded with 9 lbs., would be about 34 measures; this, expanded into 50 measures, would be of 6 lbs. pressure. Yet the water and steam in the boiler would maintain the con-

stant temperature of 238 degrees. Assume the opinion to be correct, that the whole would be reduced to 231 degrees by *condensation*, then the abstraction of 7 degrees being constant, it must be from that temperature and so following, and that reduction of temperature causing a corresponding reduction through abstraction by the pipe—a thing quite out of the question—238 degrees are constantly supplied. What would become of this 7 degrees abstracted, if the whole of the water in the boiler, the steam in the chamber, and, of course, the water flowing through the pipe—were reduced by *violent ebullition* to 231 degrees?

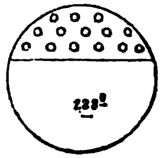
Answer continued.—If steam is brought in contact with solid substances of superior temperature, it will become *superheated*, whereby it expands in nearly the same ratio as air or any other permanent elastic fluid, &c. A hot bar of iron being thrust through the pipe of No. 2, is not exactly the reverse of the first experiment, because, by merely superheating the steam 7 degrees, its elastic force will be raised to $6\frac{1}{8}$ lbs. to the square inch, instead of 9 lbs., the temperature of the water will rise nearly $\frac{5}{8}$ degrees in consequence of this increase of pressure. If steam of any pressure and corresponding temperature mixes with steam of inferior pressure and temperature, although it can neither impart or abstract heat to or from the latter, the temperature of the mixture will be such as is due to steam generated under the medium pressure.

(*Quere.* Does not this involve something of a contradiction?)

With regard to question No. 4, I repeat that it is impossible for water to boil at all, under any circumstances, unless its temperature has been raised to the boiling point which has been fixed by the pressure. If, therefore, a communication is established between the two boilers, steam will rush from No. 1 into No. 2; the ebullition in No. 2 will instantly cease, but will become very violent in No. 1 until, after a few minutes, the pressure and temperature of the water in both boilers will be equalized. I see no anomaly in the circumstance that the ebullition in No. 2 ceases awhile, because the constant supply of heat under the boiler is merely *stored up*, but certainly not lost.

Remarks.—I think no doubt can possibly exist, that if steam of the temperature of 238 degrees, and consequent pressure of 9 lbs., be made to pass from boiler No. 1 through a pipe in No. 2, constantly depositing 7 degrees of heat, and escaping through a safety valve loaded with 9 lbs. to the inch, its quantity only will be reduced, the temperature remaining the same, about one-third being carried off by the pipe, and the residue by the escaping steam.

Suppose a sufficient number of pipes to pass through the steam chamber, with water flowing through them, to carry off the whole 238 degrees.



Would not the whole steam generated in the boiler be thus *condensed*, and, notwithstanding this *condensation*, would not the constant supply from the furnace keep up the temperature of the water to the given standard of 238 degrees? And if so with the whole, would there not be an equal proportion with all the parts? If one-hundredth part of the steam generated were suffered to escape, 99 would then be carried off by the pipes, certainly without affecting the temperature. In what degree would the case be altered if one-half or two-thirds were thus suffered to escape, and the residue given over to the pipes? I think the assumption, that it is impossible for water to boil at all, under any circumstances, unless the temperature has been raised to the boiling point, &c., is too comprehensive. If it means until the whole is so raised, it is certainly erroneous. Red-hot iron applied to the surface of ice will cause ebullition and create steam, imparting no heat to the mass. It is well known that heat radiates equally on every side, and the surface water in a boiler is as good a recipient for this heat as any other substances. It will not penetrate the

mass, simply because the steam it creates is constantly carrying it off. If heat applied to the surface of ice will produce steam, will not the same heat applied to a surface of water already raised to the point of 231 degrees produce a similar effect in a greater degree? The heat constantly abstracted by No. 2 will not be lost, nor will it go alone to superheating the steam in its chamber—that superheated steam will have the same effect on the surface of the water as so much heat applied through any other means.

It is admitted that if steam, of any pressure and corresponding temperature, mixes with steam of inferior pressure and temperature, the temperature of the mixture will be such as is due to steam generated under the medium pressure; but it is said, that if a communication is established between the two boilers, steam will rush from No. 1 into No. 2; the ebullition of No. 2 will instantly cease, but will become very violent in No. 1 until, *after a few minutes*, the pressure and temperature of the water in both boilers will be equalized. It will hardly be contended that when this equalization has taken place, more steam will be given out than there was when they acted separately; yet some space of time must elapse while the inferior boiler is being brought up to the superior, during which time, according to this theory, evaporation takes place only in No. 1, that in No. 2 being suspended. Say it takes only five minutes, what then will become of the 250 measures thus suspended? It cannot be given into the mass, for "when the pressure and temperature of both boilers are equalized, the temperature of the mixture will be such as is due to steam generated under the medium pressure." It can never be *more*, and, during the process of equalization, it must necessarily be *less*. Is there no anomaly in this hypothesis? and can it be said that this heat is only stored up, not lost? I hold it that superincumbent heat is just as efficient as that applied from below. On what principle are reverberating furnaces constructed else? And how is the great operation of nature, in the evaporation constantly taking place from surface moisture, to be otherwise accounted for?

TOMLINSON'S RUDIMENTS OF MECHANICS. —LAW'S RUDIMENTS OF ENGINEERING. PARTS I. AND II.

Weale's Series.

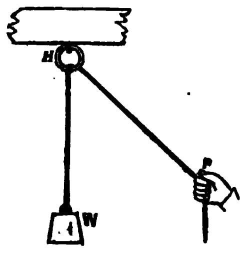
We are glad to see that the character of this most useful series of publications continues to be on the whole exceedingly well sustained.

The "RUDIMENTS OF MECHANICS" is by the same able hand of whose execution of the part devoted to "Natural Philosophy," we felt called upon to speak in very high terms (vol. xlix., p. 567). The style of Mr. Tomlinson's lessons is altogether excellent, exact, and impressive where principles are to be enunciated; copious, circumstantial, and yet clear where the application of principles to practice has to be exemplified. We take at random a few instances:

What is Gained by the Pulley?

A rope or thread, perfectly flexible and inextensible, is a machine which enables us to transmit force from one point to another in the direction of its length, as well as by a rigid bar or rod, but with this difference, that the forces which are opposed to each other must always be *divellent*, whereas with a rod they may act either from or towards each other. So far the rigid body appears to present an advantage. But the chief advantage of the rope is, that, from its flexibility, a force acting in one direction may be made to balance an equal force in any other direction. Thus the weight W, (fig.

Fig. 36.



36,) acting in the direction, H W, may, by means of a rope passing through a fixed hook or ring, H, be sustained by a power, P, acting in the direction P H. Assuming the rope to be perfectly flexible and smooth, it would suffer no resistance either from rigidity or friction in passing through the ring, and the cord would be stretched everywhere with the same force which is equal to that of the weight W.

We see, then, that the alteration in the direction of the power, by passing the rope through the ring at P, makes no difference in the power; it merely enables us to alter its direction; this, however, supposes the rope to be perfectly smooth and flexible, and the ring free from all roughness; but as it is not possible to fulfil these conditions, the friction arising from the opposite qualities is greatly diminished by substituting for the ring a wheel grooved at the circumference, and turning freely on an axle passing through its centre. Such a wheel is called a *pulley*. We have now to show how, by a different arrangement of pulleys, force may not only be transmitted, but also *concentrated* in degree, thus rendering this machine one of the so-called mechanical powers; but though the *pulley* is commonly called the third of these, yet it must be remembered, that the *cord* or rope is the efficient agent, no mechanical advantage being gained from the pulley; for the theory of the pulley, as a mechanical power, would be just as complete if the rope were passed through perfectly smooth rings, as in fig. 36. The real mechanical advantage to be derived from this machine is founded on the fact, that the same flexible cord must always undergo the same tension in every part of its length.

*　　*　　*　　*

In testing the theory of the pulley dynamically, or by the principle of virtual velocities, we find that in this, as well as in all other machines, whatever is gained in force is lost in velocity. It will be found in all the examples adduced, that the ascent of the weight is as many times less than the descent of the power, as the weight itself is greater than the power. Thus, in a combination of four pulleys, (fig. 39) if the power be 1 lb., and the weight 4 lbs., and it be required to raise the weight 1 foot, the power must descend through 4 feet; for, in order to raise the moveable block 1 foot, each of the four portions of cord by which it hangs must be shortened 1 foot; but as they all form parts of one continued cord, this must on the whole be shortened 4 feet, *i. e.*, 4 feet of cord must pass out from the system between the blocks. "What then do we gain by the pulley?" it may be asked: the answer is we gain nothing at all; for, as far as expenditure of power is concerned, we may just as well do without the machine; we gain no power by its means; all we do is to economize it and expend it gradually. In raising a weight of 50 lbs. 1 foot high, the expenditure of power is obviously the same, whether we accomplish the task by raising 1 lb. through 50 feet, or 50 separate pounds through 1 foot; and in the pulley, or any other machine, a weight of 50 lbs. cannot

Fig. 39.

be raised a given height with a less expenditure of power than is required to raise 100 lbs. half that height, or 1 lb. 50 times that height.

Effects of Velocity in the Use of Projectiles.

The greater part of the forces which impart motion to a body act directly upon only a few of its molecules: thus, when a billiard ball is struck with the cue, we touch only a small portion of its surface; when a bullet is projected from a gun, the gases suddenly evolved from the powder act upon only one hemisphere of the bullet. As all the parts of a body are set in motion by an impulse communicated to a few only of its molecules, it is clear that there must be a diffusion of motion from the parts struck or acted on over all the other parts of the body before it can begin to move. When this is not the case, the part struck is compressed, flattened, or it is chipped off, and performs its journey alone, leaving the mass behind; but when the force has time to be propagated through all the particles, the body is then impressed with a motion common to all its particles. This diffusion of motion from particle to particle requires *time;* the time may be exceedingly short, but not infinitely so; it depends upon the extent of matter to be moved, and also upon its nature, such as whether it be metal, stone, clay, wood, water, air, &c.

*　　*　　*　　*

Persons who are fond of the marvellous sometimes relate facts respecting the effects

of musket shots and cannon balls which are not generally believed, although they are simple consequences of the principles we are now considering. Thus a musket ball will pass through a window-pane without cracking the glass, leaving only a clear round hole. If the musket ball were thrown by hand the whole pane would be shattered; but with the usual velocity of a musket ball, that portion of the glass actually struck alone yields to the blow, and the ball has done its work before the surrounding parts have time to share the motion. If the window-pane were suspended by a silken thread, the shot would only carry away so much of the glass as would allow it space to pass through, without even breaking the thread or causing it to oscillate. A sheet of paper placed on edge may be perforated by a pistol ball without being knocked down; and a door half open may be pierced by a cannon ball without being shut. M. Pouillet mentions a case where a cannon ball carried off the extremity of a musket while it was in the soldier's hands without his feeling the stroke, just as the head of a thistle may be struck off by the rapid motion of a stick, without perceptibly bending the stalk. Nay, if the missile be soft, as tallow, it will act with the force of lead, if sufficient velocity be imparted to it. Thus in the well-known trick of firing a piece of tallow candle through a board, the parts of the tallow cannot yield until after a certain time; and until that time has passed the tallow behaves like a hard solid, and before its particles have had time to yield, the tallow has already passed through the board. So also in firing a cannon ball over the surface of a smooth sea, time is not allowed for the water to yield much, and consequently it behaves like a solid, and reflects the ball. In this way, it is said that musket balls have even been flattened.

Kepler's Laws.

However simple the results of Kepler's labours may appear, they could not be elicited without a degree of perseverance almost unparalleled, and of which we can hardly form an idea. He had neither the *sextant*, which has been called "a portable observatory," nor *logarithms*, by which a few lines of simple addition are made to serve instead of sheets of complex calculations. Yet thousands of observations had to be made and compared, not only to ascertain the truth of each of Kepler's laws, but the falsehood of each of his unsuccessful guesses —and these amounted, in the present case alone, to *seventeen*. His contemporaries regarded him as an useless dreamer; but without these discoveries we should have had no *Nautical Almanack*. Merchants, underwriters, the most *practical* men of the present day, stake their fortunes upon the results of these dreamy speculations of Kepler.

Newton's Discovery of Universal Gravitation.

The reader must not suppose that the merit of this grand generalization consisted merely, or indeed at all, in a bold and fortunate conjecture. Such a conjecture was not even new; but in order to remove it from the barren region of conjecture into that of rigid and useful demonstration, Newton had not merely to calculate, but to invent *new methods* of calculation (those previously known being wholly inadequate to solve such questions); not merely to demonstrate, but to invent new modes of demonstration, such as, though never before heard, should yet command universal assent. He had, moreover, to show how this simple idea, when fully carried out, represented *exactly*, in *number*, *weight*, and *measure*, not only the main features of planetary motion, but all its minutest details:—not only the *mean* motions, or such as are observable without actual measurement, and reconcilable with the simple notions of *circular* and uniform motion—not only the inequalities detected by a more attentive observation, and still designated by the term *anomaly* (though Kepler had just then reduced them to perfect order, and shown their dependence on the *ellipticity* of the orbits,)—not only the still smaller, and till then unaccountable and seemingly capricious deviations from these laws of Kepler,—but also numerous other variations, too slow or too minute to be detected by the instruments then in use, but which improved means of observation have since rendered appreciable, thus affording continually, as the observations become more exact, new confirmations of this wonderful theory; which, among all the multifarious phenomena of falling bodies, pendulums, the earth, moon, sun, tides, planets, satellites, comets, double stars, leaves not *one* fact imperfectly explained, either as regards kind or *quantity*; whether it be a cosmical movement, perceptible only in the lapse of many ages, or the rising of one spring tide an inch higher than another, or the gain or loss of a few beats per month by a pendulum placed in a new situation.

Not content, like many theorists, with proving that his assumed force would be sufficient to produce all the observed effects, Newton undertook to prove that *no other* force could possibly explain them; no other being reconcilable with the laws which had just been established by the indefatigable labours of Kepler.

The narrow limits to which the author has been confined by the price and size of his treatise has caused him to be disproportionately brief on those branches of his subject which come last in order of treatment; that of Hydrodynamics especially. We know not how this defect is to be remedied except by the publication of a Second Part, which would, we believe, be universally welcomed; for, as it is, the reader has in all conscience quite enough for his money. Like the author, we are not aware of any other treatise (on mechanics) with the same quantity of matter, and with so many engravings, which is to be had at so low a price.

The "RUDIMENTS OF ENGINEERING" is in its general design a failure, though here and there there are parts very well done—Mr. Law has literally broken down under the vastness of the task he imposed on himself. According to a "Synopsis of the Science of Civil Engineering," which he himself gives, it comprehends no less than 147 distinct subjects, besides seven which are "Collaterally Connected;" and this list moreover is stated (with truth) to be "far from including every subject with which the engineer should be conversant." How, then, could Mr. Law be expected to dispose even rudimentally of such an infinitude of topics with satisfaction to himself or his readers in a couple of treatises, containing together not quite 250 pages? About a page and a half to each! The attempt was absurd, and should not have been made.

To make the matter worse, Mr. Law has injudiciously occupied about one half of his First Part in going over a number of the same subjects which had been already treated by Mr. Tomlinson in his "Natural Philosophy," and "Mechanics," and treated too, much better.

One of his best chapters is that on Bridges, from which we extract the following interesting account of Sir M. I. Brunel's method of building arches in brick without centrings, for the engravings illustrative of which we are indebted to the courtesy of Mr. Weale.

In the construction of arches of masonry, some kind of centring is absolutely necessary for the support of the arch-stones, or voussoirs, until the keystones are inserted. But, in the case of brick arches, Sir Isambart Brunel, some years since, devised a method of constructing them, in which the use of centring was entirely dispensed with, and in consequence a considerable saving of expense effected. The piers of the bridge having been constructed in the usual manner, up to the springing, he proposed to commence building a portion of the arch right and left, on both sides, taking care that both arches progressed at an equal rate, so that they should always balance each other; in order to increase the cohesion of the structure, he introduced bands of hoop-iron, longitudinally between the courses, in the manner already explained (at page 81 of the First Part), and by these means he was enabled to carry on the two semi-arches, until they met those produced in a similar way from the opposite piers, when, the brick-work being made good between them, the arch was made perfect. He proposed that the arched rib, as it were, thus formed, should not be built more than about 4 feet in width, the true form of the arch being insured by the use of a template, as in building curved walls.

A narrow arch having been completed across, Sir Isambert proposed to extend it to the requisite width by building on each side of it, adding from 9 to 18 inches at a time, and working in steps in the manner shown in fig. 98, so that a great number of brick layers might simultaneously be employed.

It would, probably, by many persons be considered impossible thus to construct a slender arched rib of any extent, which should be capable of sustaining itself with safety, until it had attained a length equal to the semi-span of such an arch as the center one of London Bridge. Sir Isambert, however, set all doubts at rest, and demonstrated its practicability by actually constructing two semi-arches, an elevation of which is shown in fig. 99. They were built of bricks laid with mortar prepared with blue lias lime; several bands of hoop-iron $1\frac{1}{2}$ inch wide and $\frac{1}{16}$th of an inch in thickness, as well as rods of fir about an $1\frac{1}{2}$ square, and having their edges notched, were inserted longitudinally between the courses, extending throughout the whole length of the structure. The radius of curvature of the arch was 177 feet, and, although only 4 feet 6 inches in width at the top, it was extended to the length of 40 feet on each side of the centre pier. One end was some time after extended another 20 feet, making its total length from the pier 60 feet; and

Fig. 98.

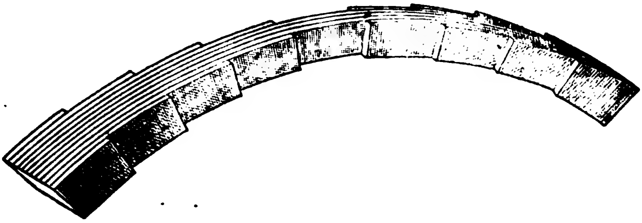


Fig. 99.

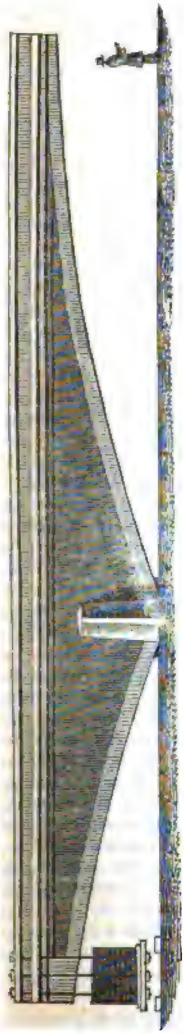


Fig. 100.

as the other side could not be extended in the same way, in consequence of want of space, a weight amounting to 28½ tons was suspended from it as a counterpoise. The structure having no foundation whatever in the ground, and merely resting upon a Yorkshire landing stone, was disturbed by some deep excavations made within a few feet of its base, which caused the arch to crack upon both sides of the pier, as shown at A, A. Although, however, the fracture extended completely through the substance of the arch, so that light could be seen through it, the structure stood in that state for upwards of three years, during which time it must have been supported by the timber and iron ties already described. The longest arm subsequently fell during the severe frost in January, 1838, in consequence of the expansion of some water which had found its way into these cracks, while in the act of freezing, the enormous force of which, assisted by the weight of the semi-arch, snapt asunder the ties, and allowed it to fall. Figure 100 exhibits the state of the arch after the accident; the portion which fell separated into three pieces, two of these, B and C, being still united by the hoop-iron bands, which were not broken; the other piece was the portion of 20 feet which had been subsequently added, and which, having been but imperfectly connected with the old work, broke off nearly even, and was not at all injured by the fall. The shorter arm of the arch, being no longer balanced by an equivalent weight, fell over into the inclined position shown in the figure, until it rested upon the top of the weight with which it had been loaded.

MR. LASSELL'S ASTRONOMICAL LABOURS.

[From the Address delivered by Sir J. F. W. Herschel, Bart., on delivering to Mr. Lassell the Honorary Medal of the Astronomical Society.]

Mr. Lassell has long been advantageously known to us as an ardent lover of astronomy, and as a diligent and exact observer. In the year 1840 he erected an observatory at his residence near Liverpool, bearing the appropriate name of Starfield, which has ever since been the scene of his astronomical labours. Even at its first erection this observatory exhibited features of novelty and interest. In addition to a good transit, it was furnished, instead of a meridian instrument or an ordinary equatorial achromatic, with a Newtonian reflecting telescope of 9 inches aperture, and rather more than 9 feet in focal length, equatorially mounted, the specula of which were of his own construction, and the mode of mounting devised by himself. This was already a considerable step, and forms an epoch in the history of the astronomical use of the reflecting telescope. Those only who have had experience of the annoyance of having to keep an object long in view, especially under high magnifying powers, and in micrometrical measurements, with a reflector mounted in the usual manner, having merely an altitude and azimuth motion, can duly feel and appreciate the advantage thus gained. But the difficulties to be surmounted in the execution of such a mode of mounting were very considerable—much more so than in the case of an achromatic,—owing partly to the non-coincidence of the centre of gravity of the telescope and mirror with the middle of the length of the tube, and partly to the necessity of supporting the mirror itself within the tube in a uniform bearing free from lateral constraint, and guaranteed against flexure and disturbance of its adjustment by alteration of its bearings. These difficulties, however, Mr. Lassell overcame; the latter which is the most formidable, by an ingenious adaptation of the balancing principle, first devised, if I am not mistaken, by Fraunhofer and Reichenbach for the prevention of flexure in the tubes of telescopes —a principle which has not received half the applications of which it is suceptible, and which, by throwing the whole strain of the weight of instruments on axes which may be made of unlimited strength, may be employed to destroy the distorting force of gravity on every other part.

The success of this experiment was such, and the instrument was found to work so well, that Mr. Lassell conceived the bold idea of constructing a reflector of 2 feet in aperture and 20 feet in focal length, and mounting it upon the same principle. The circumstances of his local situation, in the centre of manufacturing industry and mechanical construction, were eminently favourable to the success of this undertaking; and in Mr. Nasmyth he was fortunate enough to find a mechanist capable of executing in the highest perfection all his conceptions, and prepared, by his own love of astronomy, and practical acquaintance with astronomical observation and with the construction of specula, to give them their full effect. It was of course, however, the construction and polishing of the large reflector which constituted the chief difficulty of this enterprise. To ensure success, Mr. Lassell spared neither pains nor cost. As a preliminary step, he informs us that he visited the Earl of Rosse, at Birr Castle, and besides being favoured with more than one opportunity of satisfying himself of the excellent performance of that nobleman's three-foot telescope, enjoyed the high privilege of examining the whole machinery for grinding and polishing the large speculum, and returned so well satisfied as to resolve on the immediate execution of his own ideas.

The mode of casting and grinding the mirror, differing in some of the details, though proceeding generally on the same principle as Lord Rosse's (*i. e.* by a chilled casting), has been described in a communication read to this society on the 8th of December last. The polishing was performed on a machine almost precisely similar to that of his lordship. But finding, after many months' trial, that he could not succeed in obtaining a satisfactory figure, he was led to contrive a machine for imitating, as closely as possible, those evolutions of the hand by which he had been accustomed to produce perfect surfaces on smaller specula. This machine has been described (and a model of it, as well as Mr. Nasmyth's finished working drawings of it, exhibited) in a paper of great interest read at the last meeting of this society, of which also an abstract has been printed in our Notices.* Suffice it to say, that I have carefully examined both the drawings and the model, and having myself had some experience in the working and polishing of reflecting specula, approaching (though inferior) in magnitude to Mr. Lassell's, I am enabled to say, that it seems to unite every requisite for obtaining a perfect command over the figure; and

* We shall give this, as also the comment which preceded it, in a future Number.—Ed. M. M.

when executed with that finish which belongs to every work of Mr. Nasmyth, from the steam-hammer down to the most delicate product of engineering and mechanical skill, cannot fail to secure, by the oily smoothness and equability of its movements, the ultimate perfection of polish, and the most complete absence of local irregularities of surface. The only part which I do not quite like about it, or perhaps, I should rather say, which seems open to an *à priori* objection, refutable, and, in point of fact, refuted by the practical results of its operation, is the wooden polisher, owing to the possibility of warping should moisture penetrate the coating of pitch with which it is (I presume) enveloped on every side. Some unhygrometric, non-metallic substance, such as, for instance, earthenware, porcelain biscuit, or slate, would be free from this objection, though possibly open to others of more importance.

Both Mr. Lassell and Lord Rosse appear to be fully aware of the vital importance of supporting the metal, not only while in use, but also while in process of polishing, in a perfectly free and equable manner; but the former has adopted a mode of securing a free bearing on the supports, by suspending the mirror, which is a great and manifest improvement on the old practice of allowing it to rest on its lower edge, by which not only is the figure necessarily injured by direct pressure, but the metal is prevented from playing freely to and fro, and taking a fair bearing on its bed. As I have, however, on another occasion enlarged on the necessity of making provision against these evils, by a mechanism almost identical in principle, I need not dwell upon this point farther than to recommend it to the particular attention of all who may engage in similar undertakings.

It is right that I should now say something of the performance of the nine-inch and two-feet reflectors. And first, as regards the success of the system of mounting adopted in securing the peculiar advantages of the equatorial movement. This appears to have been very complete. The measurements, both differential and micrometrical, made with them, and recorded in our Notices, show that, in this respect, they be considered on a par with refractors, and in facility of setting and handling they appear nowise inferior. Of the optical power of the former, two facts will enable the meeting to form a sufficient judgment. With this instrument Mr. Lassell, independently, and without previous knowledge of its existence, detected the sixth star of the trapezium of θ Orionis. And with this, under a magnifying power of 450, and in very unfavourable circumstances of altitude, both himself and Mr. Dawes became satisfied of the division of the exterior ring of Saturn into two distinct annuli, a perfectly clear and satisfactory view of the division being obtained.

The feats performed by the larger instrument have been much more remarkable and important. It has established the existence of at least one of the four satellites of Uranus, which since their announcement by Sir W. Herschel had been seen by no other observer, viz., the innermost of all the series, and afforded strong presumptive evidence of the reality of another, intermediate between the most conspicuous ones. The observations of M. Otto Struve, if they really refer to the same satellite, are of nearly a month later date.

To Mr. Lassell's observations with this telescope we also owe the discovery of a satellite of Neptune. The first occasion on which this body was seen was on the 10th of October 1846, but owing to the then rapid approach of the planet to the end of its visibility for the season, it could not be satisfactorily followed until the next year, when, on the 8th and 9th of July, observations decisive as to its reality as a satellite were made, and in August and September full confirmation was obtained. This important discovery has since been verified both in Russia and in America. I call it so, because, in fact the mass of Neptune is a point of such moment, that it is difficult to overrate the value of any means of definitively settling it. Unfortunately, the exact measurement of the satellite's distance from the planet is of such extreme difficulty, that up to the present time astronomers are still considerably at issue as to the result.

I come now to the most remarkable of Mr. Lassell's discoveries, one of the most remarkable, indeed, as an insulated fact, which has occurred in modern astronomy; though, indeed, it can hardly be regarded as an insulated fact, when considered in all its relations. I need hardly say that I allude to the discovery of an eighth satellite of Saturn, a discovery the history of which is, in the highest degree, creditable, not only to the increased power of the instruments with which observatories are furnished in these latter days of astronomy, but also to the vigilance of observers. If I am right in the principle, that discovery consists in the certain knowledge of a new fact or a new truth, a knowledge grounded on positive and tangible evidence, as distinct from bare *suspicion* or *surmise* that such a fact exists, or that such a proposition is true—if I am

right in assigning as the moment of discovery, that moment when the discoverer is first enabled to say to himself, or to a bystander, "I *am sure* that such is the fact—and I am sure of it *for such and such reasons*," reasons subsequently acquiesced in as valid ones when the discovery comes to be known and acknowledged—if, I say, I am right in this principle (and I really can't find no better), then I think the discovery of this satellite must be considered to date from the 19th of September last, and to have been made simultaneously, putting difference of longitude out of the question, on both sides of the Atlantic. In speaking thus, I desire, of course, to be understood as expressing only my own private opinion, and in no way as backing that opinion by the authority of the Society whose chair I for the moment occupy. The Astronomical Society receives with equal joy the intelligence of advances made in that science, from whatever quarter emanating, and accords the meed of its approbation to diligence, devotion, and talent, with equal readiness, wherever it finds them; but declines entering into *nice* questions of personal or national priority, and would, I am sure, emphatically disavow the assumption of any title to lay down authoritatively rules for the guidance of men's judgments in such matters. The medal of this day is awarded to Mr. Lassell, not on account of this discovery alone, and as such, but as taken in conjunction with the many other striking proofs he has afforded of successful devotion to our science, both in the improvement and in the use of instruments. And among the motives which have induced your Council to place Professor Bond on the list of our associates (I trust not long to be the only one of his countrymen by whom that honour is enjoyed), though this discovery has had its due and just weight, we have not been unheedful of his general merits, both as an observer and as a theoretical astronomer—merits of which the Memoirs which have recently reached us, convey the most abundant evidence in both departments.

I have observed that, when taken in all its relations, the discovery of an eighth satellite of Saturn cannot be regarded as quite an insulated fact. Between Iapetus and Titan there existed a great gap unfilled, in which (as formerly between Mars and Jupiter) it was not in itself unlikely that some additional member of the Saturnian system might exist. The extreme minuteness of Hyperion forcibly recals the analogous features of the asteroids, and it would be very far from surprising, if a farther application of the same instrumental powers should carry out this analogy in a plurality of such minute attendants.

Mr. Lassell, as you are all well aware, is bound to astronomy by no other tie than the enjoyment he receives in its pursuit. But in *our* estimation of his position as an amateur astronomer, it must not be left out of consideration, that his wordly avocations are such as most men consider of an engrossing nature, and which entitle them, in their moments of relaxation, as they conceive, to enjoyments of a very different kind from those which call into fresh and energetic exertion all their faculties, intellectual and corporeal. It is no slight and desultory exercise of those faculties which will enable any man to carry into effect so much thoughtful combination, and to avail himself with so much consecutiveness of their results when produced. And however we may and must acknowledge that such a course of action is really calculated to confer a very high degree of enjoyment and happiness, we ought not to feel the less gratefully towards those who, by their personal example, press forward the advent of that higher phase of civilization which some fancy they see not indistinctly dawning around them; a civilization founded on the general and practical recognition of the superiority of the pleasures of mind over those of sense; a civilization which may dispense with luxury and splendour, but not with the continual and rapid progress of knowledge in science and excellence in art.

I think I should hardly be doing full justice to my subject, or to the grounds taken by the Council in the award, if I were to conclude what I have to say otherwise than in the pointed and emphatic words of a report officially embodying the prominent features of the case. "The simple facts," says that document, "are, that Mr. Lassell cast his own mirror, polished it by machinery of his own contrivance, mounted it equatorially in his own fashion, and placed it in an observatory of his own engineering: that with this instrument he discovered the satellite of Neptune, the eighth satellite of Saturn, and re-observed the satellites of Uranus. A private man, of no large means, in a bad climate" (nothing, I understand, can be much worse), "and with little leisure, he has anticipated, or rivalled, by the work of his own hands, the contrivance of his own brain and the outlay of his own pocket, the magnificent refractors with which the Emperor of Russia, and the citizens of Boston, have endowed the observatories of Polkowa and the Western Cambridge."

IMPROVEMENT OF HARBOURS AND RIVERS. FROM THE UNPUBLISHED PAPERS OF THE LATE BRIG.-GEN. SIR SAMUEL BENTHAM.

In considering back-water for scouring harbours, *expanse* of water at *high* water has usually been more regarded than cubical quantity; whereas, on the contrary, a little reflection would show that the good effect of the exit of water in carrying out mud and sand to sea, is greater or less in proportion to cubical quantity and velocity.

I am convinced that there are a great variety of cases in which a harbour might be very greatly improved by digging out a portion of the soil which lies *between high and low* water *neap* tides, and throwing it upon the parts overflowed only at spring tides; an influx of water into the harbour would thereby be obtained as great on *every* recurring tide, as now takes place during spring tides only; consequently but for two or three, or at most a few days, once a fortnight.

In Portsmouth Harbour an immense expanse of mudlands is, under circumstances which render the water which sometimes covers them, of little use in cleansing the harbour; whilst by a judicious application of this idea, however new in practice, many of the channels might be cleared so as to afford very advantageous improvements with a view to navigation; at the same time, much of the mudland lying above the level of high-water neap tides might be raised so as to become useful in parts where land is very valuable. By due attention to this idea as a rule, channels might be excavated in that harbour, so as that the land gained would overpay the expense of the improvement of the harbour, and of obtaining thus a great addition of water for scouring purposes.

Although, as I long ago stated, what I consider would be the greatest improvement of Portsmouth Harbour by means of Langston Harbour, were not to be executed, yet the digging out of channels as above indicated is highly desirable on sanatary accounts; also, since the very noisome stench with which the towns of Portsmouth and Portsea are at present infested arises from mudlands; from those in the middle of the harbour, as well as from those near the shore; upon these the filth of the towns is carried, and either left before low water to putrefy in stagnant pools, or drying upon the mud.

The water contained at this port in basins or canals, made for various useful purposes, might occasionally be in part employed, by means of sluices, to scour out at low water any channels where filth might be liable to accumulate.

Indications for the Improvement of Harbours and Rivers.

1. Straightening the banks.
2. Procuring efficient, instead of inefficient backwater. Efficiency depending on quantity, on velocity, on depth, on the uniformity of the action, on the length of time that the action is continued. This is to be done, 1st. By keeping up a head of water, to be let off through sluices at low water, to scour out the bottom effectually; 2nd. By digging out soil between low water spring tides and high water neap tides, at least, and in some cases high water spring tides, depositing the soil so thrown out either in raising low lands or in raising the land between high water neap and high water spring tides.
3. By digging out shoals, thereby preventing under-water eddies and loss of power in the bottom current.
4. By diverting muddy land water streams into other channels.
5. By preventing the influx of silt from the sea.

To prevent the muddy water of rivers which run into harbours from choking the harbour, there should be a space into which the river should expand itself, and thereby deposit what it has brought down. From that space the water should enter the harbour from the *surface* only; therefore, that space or interior harbour should be dammed up, and be entered only by a loch; but this dam should be furnished with many sluices, to be opened so as to increase the velocity of the reflux out of the principal or outer harbour during the time that the water is still high; that is, while the depth of water acting on obstructions is of as great power as possible.

STEAMERS' SAFETY RAFT.

Sir,—In your Number of Saturday last you seem disposed to award to your old correspondent, Mr. Cumberland, the

merit of having invented the safety raft of which Captain Bullock imagined himself the inventor.

I think on reflection that you will see your opinion was rather hastily pronounced, and should such be the case, I know you will be obliged to any correspondent to set you right. Mr. Cumberland proposed in 1810, before the era of steam navigation, to make every sailor's bed a life-preserver, and in case of need, to connect several of these together, and form a raft. Captain Bullock, in the latter part of 1848, or beginning of 1849, suggested that the bridges of steamers used for communicating from one paddle-wheel to the other, should be so fitted as to float off their bearings in the event of the vessel foundering, and form a safety raft.

Captain Bullock was of course not aware that Captain George Smith, the well known inventor of the safety paddle-box boats, had exhibited at Portsmouth, to the Lords of the Admiralty, and at the Polytechnic Institution in 1844, a model of a safety raft, precisely similar to that of Captain Bullock, and at the time proposed that the bridges of all steamers should be made to serve the double purpose of a road from one paddle-box to another, and in case of the vessel going down, of a safety-life raft.

Allowing all credit for proposing the cork beds to Mr. Cumberland, I think we shall be but doing justice to a most excellent and ingenious officer in awarding the merit of the invention of the safety-bridge raft to Captain George Smith.

I am, Sir, yours, &c.

PALMAM QUI MERUIT FERAT.

April, 15, 1849.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING 19TH OF APRIL.

DANIEL WATNEY, Wandsworth, Surrey, distiller, and JOHN JAMES WENTWORTH, of the same place. *For improvements in machinery for drilling metals and other substances.* Patent dated October 12, 1848.

Where holes have to be bored in rocks, or in large masses of stone or metal which cannot be readily moved, there is often considerable difficulty experienced in so fixing the drilling tool as to obtain the necessary purchase. To obviate such difficulty in all cases is the object of the present invention. A rectangular metal frame is supported loosely on a foot by a screw and nut, which allows it to turn freely in any direction, and it is furnished at top with a screw, carrying a circular disc, which is also free to revolve thereon. This frame is maintained in a vertical or horizontal position by having the foot and disc screwed into contact with the floor and ceiling, or to the two sides of a chamber or mine. A block of metal slides up and down the space of the frame, and is fitted with clamp pieces and a screw, carrying at one end a socket-head, and at the other a nut, whereby it may be maintained stationary at any required distance from the foot piece. This socket carries a screw, having a hole bored in its head, to serve as a bearing to the drill, so that it may be made to work in a horizontal or vertical line, or in a direction at any desired angle to either of them. Motion is communicated to the drill from a prime mover in the ordinary manner.

Claim.—The mode of combining the parts before described into a machine for drilling metal and other substances.

CHARLES DE BERGUE, Arthur-street West, City of London, engineer. *For improvements in bridges, girders, and beams.* Patent dated October 12, 1848.

The improvements sought to be secured under this patent consist—

1. Of a peculiar mode of constructing compound tension bars or rods, which are intended to take the place of chains in suspension bridges; and,

2. Of a mode of constructing girders, beams, and bridges.

A girder bridge is described by the patentee, in which the compression rod is represented as composed of a series of tubes of different diameters, cast with flanges accurately fitted, whereby they may be bolted together into a curvilinear line, the curve of which may be varied according to circumstances. The end tubes are made with projecting ribs, to which flanges are attached, and thereby supported against suitable abutments of masonry. The tension rod is composed of iron or steel plates, riveted together, or to an iron plate, and made to abut against the lower ends of the struts which are attached by angle irons to the edges of two or more transverse iron plates, riveted together and bolted to and in between the flanges of the tubes, while the top ends of the struts are bent over the joints of the tubes. Tie rods are fastened to the lower ends of the struts, and to bolts in the compression rods, the ends of which are slightly eccentric and squared, so that they may be laid hold of and partially turned round by spanners and the structure tightened. The

roadway is connected to the sides by cross beams, reaching from strut to strut, composed of iron plates riveted together and strengthened by angle iron.

Instead of metal tubes, timber beams may be used, and so arranged in pairs, as to exhibit only one joint in a transverse section through any part of it. The struts and tie rods are supported at suitable distances by a series of plates, consisting of three each, which are bolted to the two outsides and in between the beams. The inside plate in each series is made longer than the other two, and takes into slots in the transverse metal plates to which it is attached by rivets and angle iron.

The tension bars are composed of a number of parallel steel plates bolted together and to a number of iron plates rendered continuous by lap pieces riveted over their joints. The steel plates are arranged so as to break joint, and the iron plates are made with slots, up through which pass T or saddle pieces, that rest upon the tension rod, and have the vertical supporting rods connected to their lower extremities by double joints.

The tension rod may have the iron plate cast with hollow spaces and semicircular lateral projections at those parts where the steel plates are riveted to its underside; or the steel plates may be united to pieces of angle iron bolted to each side of the iron plate. Or the iron plate may be made with a cross piece at bottom in the shape of ⊥, to which the steel plates are riveted.

Claims.—1. The application of tension bars consisting of plates of iron or steel, or wrought iron and steel, riveted together, to and for the purposes before described.

2. The general arrangement of parts before described when applied to the construction of bridges, girders, and beams.

ARTHUR DUNN, Dalston, chemist. *For improvements in ascertaining and indicating the temperature and pressure of fluids.* Patent dated October 12, 1848.

This invention consists—

1. In a method of so combining and applying thermometric apparatus and electric currents as to ascertain and indicate the temperature and pressure of fluids in vessels, which is stated to be particularly applicable to steam and other close boilers.

2. In combining electric apparatus with steam or pressure gauges, so as to indicate when the pressure of the fluid arrives at a certain determinate point.

1. The temperature and pressure-indicating apparatus consists of a glass tube, bent at right angles, the upper or vertical limb of which is supported in the top of the steam boiler, while the horizontal limb is immersed just beneath the water line, and curved so as to come into contact with the sides. The outside of the tube is provided with a branch, into which are fitted two glass pipes, which, together with the branch, are filled with mercury. One of the glass tubes contains an iron float, armed at top with a platina point. A metal standard attached to, but insulated from the boiler, carries at top a sliding piece capable of being adjusted to any height by means of a set screw. A plate, carrying underneath a platina point, is supported upon an arm attached to, but insulated from, the sliding piece. The sliding piece carries a horizontal lever, which is furnished at one end with a platina point, which rests against the platina point on the underneath side of the plate, while the other end is connected to a piece of wire dipping into the glass tube, and terminating in a platina point. This plate is connected by wire to an ordinary telegraph bell-ringing apparatus, whence it passes to a Smee's or other suitable battery, and then to the branch to complete the electric circuit. The length of the wire in the tube is so regulated that when the float is forced up by the mercury until it arrives at the point determined for the working pressure of the steam, it shall complete the circuit, by coming into contact with the wire, and ring the bell. When the float passes the working point, it separates the platina point of the lever from that of the plate, and thereby breaks the circuit, on which the bell ceases ringing. A graduated scale may be affixed to the glass tube containing the mercury, to indicate the temperature of the fluid.

2. The apparatus for indicating when the pressure of the steam exceeds a certain determinate point, resembles the preceding, with the exception of the iron float and graduated scale, the use of which is in this case dispensed with. A wire, armed with a platina point, is suspended in a glass tube, and connected with a battery and ringing apparatus, and with the mercury in the branch to complete the circuit. The length of the wire is so regulated that the platina point may be just above the part to which the mercury would ascend when the steam is at its safe working pressure; and, consequently, when the pressure increases and the mercury passes that determinate point, it comes into contact with the platina point, and completes the electric current, whereby the bell apparatus is made to ring. Any suitable signal apparatus may be substituted for bells, and any number of such apparatuses employed, placed near to or at a distance from the boiler. Two or more wires, insulated from each other, may be placed in the

tube, so as to indicate different degrees of pressure of the fluid.

Claims.—1. The so combining and applying of thermometric and electric apparatus as to ascertain and indicate the temperature and pressure of fluids.

2. The combining of electric apparatus with steam or pressure gauges, to ascertain the pressure of fluids.

JOHN ASHBY, Carshalton, Surrey, miller. *For certain improvements in cleansing grain and dressing meal.* Patent dated October 12, 1848.

The improvements which form the subject of this patent have reference,

1. To the machines now ordinarily used for cleansing grain; and

2. To the application of an exhausting apparatus to flour and meal-dressing machines

1. The improved grain-cleansing machine consists of a cylinder keyed upon a vertical axle, and placed within a fixed cylinder, supported in a cylindrical case. The peripheries of the two cylinders are composed of a number of angular iron bars, held together by strips of interlaced sheet metal, placed at sufficient distances apart so as not to interfere with their working surfaces. A receiving case is attached to the cylindrical case, and is furnished at top with an exhausting fan wheel, and at bottom with three apertures, two for conducting the grain and refuse matters into separate receptacles, and one for the admission of air. The grain, which is made to fall between the inside and outside peripheries of the two cylinders, has the smut, &c., separated from it by contact with these two ribbed surfaces, and ground to powder. Such portion of smut as does not escape through the periphery of the fixed cylinder, is conducted along with the grain by a shoot (fitted with a cover, to prevent the passage of air into the interior of the cylinder) into the receiver, where it is met by the inflowing current of air created by the exhausting apparatus, which separates the refuse matters from the grain. The size of the space inside the receiver, in which the partial vacuum is to be created, is regulated by a hinged partition supported just above the cover of the shoot. The rate of admission of air, and the height to which the grain may be carried by it, are regulated by two partitions hinged to the bottom of the receiving case, behind the two apertures respectively. The grain and smut as it flows through the shoot meets with the current of air, which carries the grain over the first small partition, when it is intercepted by the second partition, and made to fall through the first aperture into its appropriate receptacle, while the refuse matters, by means of their inferior gravity, are carried over the second small partition, and allowed to fall through the second aperture into a separate receptacle.

Instead of making the receiving and cylindrical cases fixtures, the component parts may be reduced, and the whole made movable, to suit the convenience of farmers.

2. The improved flour or meal-dressing machine consists of a wire gauze cylinder, supported upon a vertical axle, which carries the ordinary distributing brushes, and the whole is enclosed in a fixed cylinder provided with an opening on one side. To this opening a vertical tube is attached, which carries at top the exhausting fan wheel. The flour or meal to be cleansed is fed through a hopper to the distributing brushes, and is, by their centrifugal action, driven against the meshes of the wire gauze cylinder, through which it and the air entering with it are drawn by the exhausting apparatus. The flour, then freed from the centrifugal action of the brushes, falls upon one or other of the two revolving tables provided for that purpose, according as it is "firsts" or "seconds," while the bran falls through the cylinder into a suitable receptacle. In applying these improvements to the inclined cylinder meal-dressing machine, brushes are made to act on the outside against the spaces between the supporting rings of the wire gauze cylinder, to keep the meshes free and open. These brushes are attached by projecting pieces to a rocking bar, loosely supported in suitable bearings, to allow the longitudinal supports of the cylinder to pass underneath them. A traversing motion in the direction of the axle of the cylinder is communicated to the rocking bar by the intervention of suitable gearing from the revolving main shaft of the cylinder.

Claims.—1. Covering the cylinders of grain-cleansing machines with a fabric composed of angular iron bars, held together by strips of interlaced sheet metal, and set at sufficient distances apart.

2. The arrangement for regulating the current of air in grain-cleansing machines.

3. The application to flour and meal-dressing machines of an exhausting apparatus, whereby the air which enters the dressing cylinder or bolting cloth with the flour or meal is drawn through the periphery.

4. Giving a traversing motion, in the line of the dressing cylinders' axis, to the external brushes.

ELIAS ROBISON HANDCOCK, 16, Regent-street, London, and Rathmoyle House, Queen's County, Ireland, Esq. *For certain improvements in mechanism applicable to impelling and facilitating the propulsion of*

vessels in the water, which improvements aré applicable to locomotive engines for railway and other similar purposes. Patent dated October 12, 1848.

These improvements refer to a particular description of rotary engine (known, we believe, as Macintosh's Engine), and to the mode of connecting it with the driving parts of machinery. The engine referred to consists of a three-sided annulus or cylinder, stayed by spokes, as in the case of a wheel, and keyed upon the centre of the shaft. A rectangular block of metal, which serves the office of a piston, is permanently attached to these three sides; and it has but one rubbing surface, in consequence of its being made to revolve along with the cylinder and main shaft. The fourth side of the annulus or cylinder is closed by means of a circular stationary plate, ground to fit it, and cast with rings or flanges to serve as a bed to a metal ring which covers the joint between the annulus and the fixed plate, and to retain a packing of hemp, asbestos, or soft metal in its place, which acts as a kind of stuffing-box to the cylinder, and prevents the escape of steam beyond the piston. The metal ring and packing are secured in their place by an outside ring and screw bolts, so that the degree of pressure on the face of the piston may be regulated according to circumstances. The eduction and induction ports, valve-box, and reversing gear, &c., which in their general construction are similar to those that are used and well known, are attached to the fixed circular plate, which is supported by braces on a standard fixed to a framing. The steam slides are worked by a cam on the main shaft; and the paddle-wheels, screw, or driving wheels are keyed upon the main shaft, with which they revolve, and consequently with the piston and cylinder. A reciprocating engine may be constructed of a pair of these cylinders, with their appurtenances, attached together, back to back, and keyed upon the same main shaft. The pistons are set at right angles to each other, and the respective steam valves are worked by separate combinations of springs and jointed levers, actuated by cams set at right angles to each other upon the main shaft. In the case of locomotives, the frame to which the standard is attached that supports the fixed circular plate is fastened to the frame of the carriage, while the engine revolves with the main shaft and driving wheels. A modification of this engine is described, which consists in making the periphery of the annulus stationary, instead of the other side or "circular plate," with such other arrangements of details as this alteration would suggest.

Claims.—1. The general arrangement of parts which constitutes the revolving or rotary engine (as improved.)

2. The block or piston fastened permanently steam-tight to the sides of the annulus or cylinder, with which it revolves (having no friction on three of its faces) as also with the shaft or axle, on which are keyed the paddle-wheels or screw for marine purposes, or the driving wheels of a locomotive for railway or common roads.

3. The stationary circular plate to which are attached the induction and eduction ports and steam valve, &c., and which is cast with rings or flanges for retaining the metal rings and packing in their places.

4. The peculiar adaptation of this engine to locomotive purposes, in which it is permanently attached to and revolves with the driving shaft and wheels, and requires no external additional fulcrum but such as is supplied by the action of the running wheels upon the rails or road.

5. The means of adjusting or retaining the metal rings and the packing of hemp, asbestos, or metal, and the use of the braces or plates, and the support in combination with the circular and stationary plate.

JOHN DAVIE MORRIS STIRLING, Black Grange, N. B., Esq. *For improvements in the manufacture of iron and metallic compounds.* Patent dated October 12, 1848.

This invention relates to the manufacture of malleable iron, and to certain combinations of alloys of malleable iron, and cast iron, and of malleable iron or cast iron, or malleable and cast iron with other metals.

1. The improvement in the manufacture of malleable iron consists in mixing a quantity of scrap iron with cast iron in the proportion of one-twentieth to one-fifth or even a fourth part, by weight, of the former to the latter, whereby the refining process may be wholly or partially dispensed with. The malleable scrap iron may be introduced into hollows in the bed of the pig furnace containing the cast iron, and melted with it; after which it is boiled and puddled, or puddled only in the ordinary manner. Or, the malleable, scrap, and cast iron may be melted in a suitable furnace, and then run into pigs or slabs, or into a puddling furnace. Or, the scrap may be heated in a furnace, but not sufficiently high for the pieces to stick together, and the melted cast iron then run into it, and the fusion of the two completed. These proportions will, of course, have to be varied according to the nature of the cast iron. The quality of the malleable iron will be much improved by mixing with it refined iron or steel scrap, when either of

these materials can be easily and cheaply obtained.

The patentee then specifies several combinations of malleable, scrap, and cast iron with different metals, which are as follows:—

1. A given quantity of the preceding combination is mixed with from $\frac{1}{100}$th to $\frac{1}{250}$th part of its weight of block or grain tin; or,

2. With $\frac{1}{100}$th part of its weight of zinc, or any one of its oxides (calamin being preferred;) or,

3. With from $\frac{1}{100}$th to $\frac{1}{250}$th part of its weight of copper mixed with one per cent. of the black oxide of manganese of commerce.

In order to mix the zinc with the iron, the molten metal is run out of the cupola or other furnace, and the blast pipe closed. The zinc is then placed upon the coke, and, when melted, runs through it and combines with the iron which adheres to the sides of the furnace. The proportion of zinc to iron should be between 4 and 7 of the former to 1 of the latter, and may be employed when mixed with a small quantity of lead to prevent its heating, for bearings, &c. And

Lastly. The patentee proposes to manufacture a substitute for gold, which he terms "British Gold," by mixing 1 part of the zinc alloy of iron with 4 parts of copper and manganese; and a substitute for silver, by mixing 6 parts of the zinc alloy of iron with 2 of nickel and 10 of copper.

The combination of copper and manganese is effected by placing them in a crucible covered with a suitable flux, and applying heat until they fuse. The proportion of manganese to copper should be from one to two per cent.

[The patentee makes no claim to any of the various processes and combinations described in his specification.]

WEEKLY LIST OF NEW ENGLISH PATENTS.

Gaspard Brandt, of Little Gray's-inn-lane, Middlesex, machinist, for improvements in the construction of the bearings of railway engines, and railway and other carriages now in use. April 13; six months.

James Childs, of Earl's-court Road, Old Brompton, Middlesex, wax bleacher, for improvements in the manufacture of candles, night lights, and candle lamps. April 16; six months.

Thomas Cocksey, of Little Bolton, Lancaster, millwright, and James Nightingale, of Brightmet, of the said county, bleacher, for certain machinery to facilitate the washing and cleansing of cotton and other fabrics, which machinery is applicable to certain operations in bleaching, dyeing, printing, and sizing warps and piece goods. April 16; six months.

Louis Prosper Nicolas Duval Piron, engineer, of Paris, for certain improvements in tubes, pipes, flags, kerbs for pavement and tram roads. April 16: six months.

Charles Shepherd, of Leadenhall street, London, chronometer maker, for certain improvements in working clocks and other time keepers, telegraphs, and machinery by electricity. April 16; six months.

Robert Clegg, Joseph Henderson, and James Calvert, of Blackburn, Lancaster, manufacturers, for certain improvements in looms for weaving. April 16; six months.

John Ruthven, engineer, Edinburgh, Scotland, for improvements in preserving lives and property from water and fire, and in producing pressure for various useful purposes. April 16; six months.

William Henry Phillips, of York-terrace, Camberwell New Road, Surrey, engineer, for improvements in extinguishing fire, in the preparation of materials to be used for that purpose, and improvements to assist in saving life and property. April 16; six months.

William Little, of the Strand, for improvements in the manufacture of materials for lubricating machinery. April 16; six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in machinery for the manufacture of net lace or other similar fabrics April 16; six months.

William Hyde Knapp, of Long-lane, Borough of Southwark, chemist, for improvements in preparing wood for the purposes of matches and firewood. April 17; six months.

Thomas Nicholas Greening, of the firm of Messrs. Burdekins and Greening, of Sheffield, cutlery manufacturers, for improvements in knives and forks. April 17; six months.

Alexander Alliott, of Lenton Works, Nottingham, bleacher, for improvements in apparatus for ascertaining and for marking or registering the force or pressure of wind, of water, and of steam; the weight of goods or substances, and the velocity of carriages; also in apparatus for ascertaining, under certain circumstances, the length of time elapsed after carriages have passed any given place, and for enabling the place or direction of floating bodies to be ascertained. April 17; six months.

George Remington, of Warkworth, Northumberland, civil engineer, for certain improvements in locomotive, marine, and stationary steam engines, and in hydraulic and pneumatic engines. April 17; six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in boilers or steam generators. (Being a communication.) April 17; six months.

Henry Bessemer, of Baxter-house, Middlesex, for improvements in the methods of extracting saccharine juices from the sugar cane, and in the manufacture of sugar, as also in the machinery or apparatus employed therein. April 17; six months.

John Ormerod, of Holt Holme Mill, near Newchurch, Lancaster, spinner, for improvements in carding cotton, and other fibrous substances. April 19; six months.

Robert Gordon, of Heaton Norris, Lancaster, engineer, for certain improvements in the ventilation of mines. April 19; six months.

N.B. This patent was not sealed till the 19th but bears date the 4th of April, instant, per order of the Lord Chancellor, being opposed at the Great Seal.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subject of Design.
April 13	1843	William Cook	Regent-street	Transverse or cross connectors to inverted double C springs and others.
14	1844	Alexander Speirs	Vauxhall Foundry, Liverpool	Hydrant or water valve.
,,	1845	Alexander Robertson	Dublin	Gum elastic breast reliever.
,,	1846	Henry Thompson	Long Acre	Yaw for metallic joints.
16	1847	J. J. Welch and J. S. Margetson	Cheapside	Elastic aerial stock or tie.
,,	1848	W. Arkell and W. Jackson	Cheltenham	Fore carriage framing.
,,	1849	William Gent	Bennett's Hill, Birmingham	The Gemini coat.
17	1850	Joseph Wilson & C. P. Woodfin	Hull	Double stench trap.
18	1851	Henry Alexander Bodien	Pentonville	False bottom and tube for flower-pots.
,,	1852	George Forrester and Co.	Liverpool	Parts of a hydrant.

NOTICES TO CORRESPONDENTS.

A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the Claims of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d. Post Office Orders to be made payable at the Strand Office, to Joseph Clinton Robertson, of 166, Fleet-street.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1342.] SATURDAY, APRIL 28, 1849. [Price 3*d*, Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

BROOMAN'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF HINGES.

Fig. 4. Fig. 1.

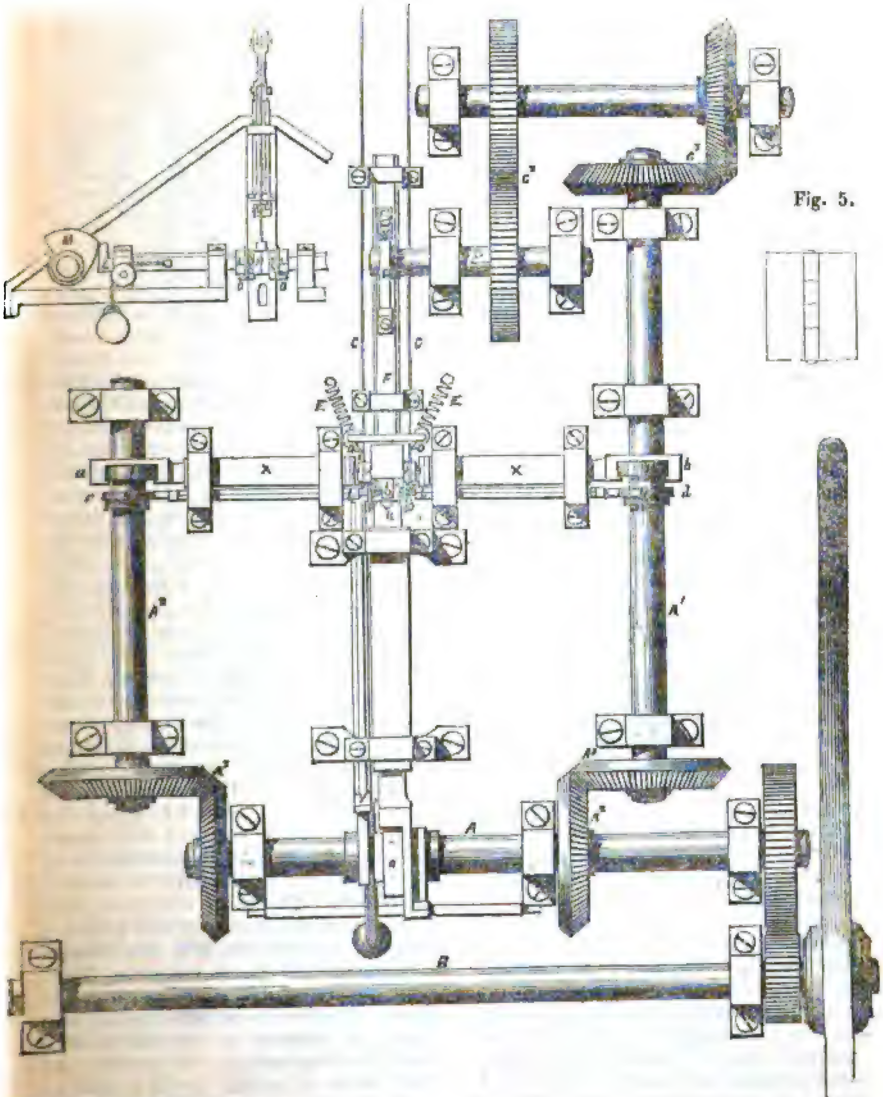
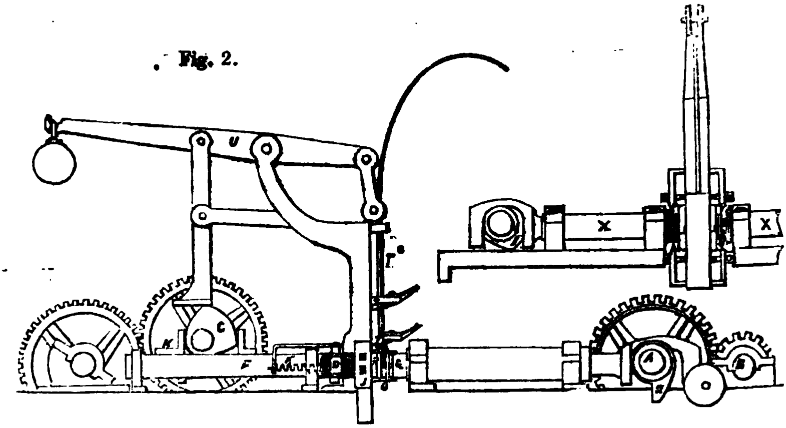


Fig. 5.

BROOMAN'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF HINGES. COMMUNICATED FROM ABROAD.

(Patent dated 2 Nov., 1848. Specification enrolled April 27, 1849.)

Fig. 2. Fig. 3.



IN the manufacture of hinges from folded plates of metal, the different processes of folding, cutting out, and boring or punching the holes for the screws and rivets, have been hitherto accomplished more or less by hand, and each of these processes has been performed as a distinct and separate act. Now, the improvements which constitute the present invention, consist in effecting by means of the machinery or apparatus represented in the figures, and afterwards described, these different operations at one and the same time, or, at least, so nearly so, that the intervals of time between them are so small that they need not be taken practically into account. Figs. 1, 2, 3, and 4 represent different views of this machinery or apparatus. Fig. 1 is a general plan, with some of the upper parts removed, which are shown in the other figs. Fig. 2 is a part side elevation; and figs. 3 and 4 are transverse elevations on the lines *a b*, and *c d*, of fig. 1.

A, is the main driving shaft of the machine, which is put in motion by gearing from the shaft, B, of some prime mover. A^1 and A^2 are two shafts, which are connected with the shaft, A, by bevel gearing, A^3, A^3, and carry two pairs of cams, I I and MM, which give an alternating motion to the rods, L L and X X, at every revolution made by the shafts, A^1 and A^2. G and R are other two cams, the former of which is affixed to a shaft, G^1, which is driven by intermediate gearing, G^2 G^2, from the shaft, A^1, and the latter to the shaft, A. The uses of these different cams will be presently explained. C C are two bands or strips of metal, out of which the hinges are to be formed; they are held in their places by grips, DD, which are affixed to a sliding bar, F, which is acted upon by the cam, G. As the bar, F, recedes from the centre of the machine, the grips, D D, glide easily over the strips of metal, C C, so as not to alter their position; but the return movement of the bar, F, causes the grips to catch the strips, C C, and make them advance towards the centre of the machine. The instant this is accomplished, the cams, I I, cause the rods, X X, which carry at their inner ends cutters, N N, and punches, H H, to press up against the strips of metal; the cutters, N N, cut off two pieces, one from each strip; each of which pieces is sufficient to form one half of a hinge. The punches, H H, at the same time, come upon the strips, and cut out the slots or mortices in both halves of the hinge (the punches on one side of the machine being exactly the reverse of those on the other side, as will be understood from the next part of the process). The two halves of the hinge cut off from

the strips, C C, having been previously punched out as described, occupy a position immediately in front of the draw or compressing plates, O O; the cams, M M, make the rods, L L, push the two halves of the hinge through the draw plates (in which state they are in a V form, as represented in the plan, fig. 1,) till they interlock the one into the other; the spaces in the one half being opposite to the solid pieces of the other. When so interlocked, the cam, G, acting upon the lever, U, causes the grip, T, to push a wire, T^2, down through a hole, *t*, into the interlocked halves of the hinge. The cam, R, then makes the matrix, Q, to advance towards a reverse matrix, P, with the partially formed hinge between them, by which latter action the hinge is pressed into its complete form, and the wire, T^2, which forms the axis of the hinge is cut off. The counterpoise upon the end of the lever, U, causes the grip, T, to slide upon the wire, T^2, so that it may take a fresh hold for the next repetition of the operation. The catch, S, which is affixed to the upright framing, holds the wire during the sliding up of the grip, T. The withdrawing of the matrix, A, allows the hinge to fall in nearly a complete state from the machine—all that remains to be done being a little dressing with the file. The holds for the screws and rivets may be punched out, at the same time as the joints of the hinge itself are being punched out by the punches, HH.

Claim.—The peculiar arrangement and construction of means constituting the improved machinery or apparatus before described, whereby the different operations in the manufacture of folded plate hinges are performed simultaneously, or as nearly so as may be.

MEMOIR OF JAMES WOLFENDEN, OF HOLLINWOOD.

Burnley, April 21, 1849.

Sir,—I enclose a short sketch of the life of one of the most noted Mathematicians of the *Lancashire School.* If you consider it worthy a place in your columns I shall feel much obliged by an early insertion. Yours respectfully,

THOMAS WILKINSON.

Memoir.

James Wolfenden, the subject of the present notice, was born at Hollinwood, near Manchester, on the 22nd day of June, 1754. His father, John Wolfenden, was a native of Higginshaw, near Royton; but having married Mary Simister, of Hollinwood, he went to reside there, and followed hand-loom weaving as an occupation. Before James had completed his sixth year his mother died, upon which his father removed to Higginshaw, and shortly afterwards to Chapel Croft, in Oldham. While residing here, a journeyman hatter taught young Wolfenden the letters of the alphabet, and though the *name* of his first instructor had escaped his memory, he ever remembered his *services* with feelings of gratitude. He remained only a short time at Oldham, being again removed to Hollinwood, where he resided with his grandfather in a secluded cottage, thatched with straw, and known by the name of the "Willows," from its being surrounded by large trees of that description. About this time he was sent to a day-school in the neighbourhood, but the bobbin-wheel and the loom being considered much more profitable employments than learning to read, he was taken away after one week's attendance, and the sum of three halfpence defrayed the expenses of his scholastic education. These deficiencies, however, were in some degree supplied by the assiduity of his grandfather, who took advantage of the intervals of leisure after the day's weaving was concluded, to instruct him in reading, writing, and arithmetic. From this stage Mr. Wolfenden may be said to be *self-taught*, if we except some occasional assistance he received from Mr. Jeremiah Ainsworth, a well known mathematician, then resident near Hollinwood. Though his days were occupied at the loom, he spent most of his leisure hours in reading all the works on science he could procure in that, *then*, thinly populated neighbourhood, so that by the time he arrived at manhood he was well acquainted with most of the principal writers on physical and mathematical subjects, and had made the works of Euclid, Newton, Simpson, and Emerson, his particular study. Simpson's *Select Exercises*, he often maintained, was "worth its weight in gold;" his *Fluxions* ever kept its place as a favourite book; and *Newton's Method of Prime and Ultimate Ratios*, forms the basis of many of his most curious and difficult

investigations. At the age of twenty-eight he married a Miss Raynor, of Hollinwood, who died within two years, leaving him one son, the present Mr. John Wolfenden, and he never married again. In his old age, when adverting to these subjects, he frequently amused his friends, by relating, that when the marriage fees were paid, their whole stock of money amounted to *one shilling*, "to set up house and begin the world with;" but, notwithstanding the low state of their exchequer, he took a house, which he occupied, until he had attended and paid rent at more than a hundred half-yearly rent-days. Mr. Wolfenden's ardour for the acquisition of knowledge, however, suffered no diminution, and his first contributions to the mathematical periodicals appear in *Burrow's Diary* for 1781, where he answers Ques. 64-5, and proposes Ques. 71.* The last question was solved by Mr. Ainsworth, with the assistance of the Conic Sections, and the proposer is said, by the editor, to have given "a very elegant solution, deduced from the Doctrine of Prime and Ultimate ratios." Mr. Wolfenden appears not to have been quite satisfied with this summary disposal of his favourite method of investigation, and the proposal of Ques. 87, concluded his correspondence to that work. This question was afterwards re-proposed, as No. 136, in *Whiting's Mathematical Delights*, to which the proposer's solution by means of "ultimate ratios," is the only one printed; and he also re-proposed the former one, under the signature "Senex," as No. 400, in the *Gentleman's Mathematical Companion*, which called forth the able and profound geometrical investigation by Mr. Butterworth, contained in pp. 764-5 of the *Companion* for 1818. He next appears in the *Gentleman's Diary* for 1783, where the solution to Ques. 495, and the proposal of Ques. 506 sufficiently evince his proficiency in geometrical investigation. To *Whiting's Mathematical*, *Geometrical*, and *Philosophical Delights*, he also contributed several curious and difficult questions, which may be seen in Articles 17 and 20 of that work: it will be observed, he here employs his favourite method in the solution of Questions 136-7. In 1797 the first number of the *Student* was published by his talented friend and pupil Mr. William Hilton; and Mr. Wolfenden appears as the proposer of the 16th, and Prize Questions. He was very liberal in his contributions to the second Number of this work, which was contrary to his usual practice; but the reason may be found in his partiality for its conductor; the only solution to the Prize Question was furnished by himself. To the third Number he contributed Props. 35, 6, 7, 8, 9, of the well-known and valuable "Modern Geometry," as also solutions to the 36th and 37th questions. The first of these is the Prize in the *Ladies' Diary* for 1791, and was re-proposed on account of the solution by Lieut. Mudge not appearing satisfactory; the second question is the 25th, in *Burrow's Diary* for 1777, which was answered by the editor in 1779; "but, as that answer is false in *principle*, the question was re-proposed with a view to have the error pointed out, and a true solution given to the problem." Fluxional solutions were given to this question in the *Student*, by Laputiensis and Mr. Wright; but the proposer's, by the method of limits, is the only one printed. The 53rd, 72nd, and 73rd questions in this work were proposed by him, to the first only of which were solutions given. The last question was re-proposed as the Prize in the first number of the *Mathematical Associate*, and was ably answered by Mr. Jones, Professor Gill, and Dr. Rutherford. Some able solutions were furnished by Mr. Wolfenden to the fourth number of the *Student*; and it has been stated, that the dread of a dispute between himself and some of the other contributors respecting the 73rd question led to the discontinuance of the work. His correspondence to the *Gentleman's Mathematical Companion* has already been noticed in pp. 401-2, and 467, vol. xlviii. of this Magazine, so that little need be added here on the subject. It may, however, be stated, that several manuscript solutions to questions in that work are still in existence, which, together with those printed, fully prove him to have been considerably in advance of most mathematicians of his time in mechanics and physical science.

* "Given the base and vertical angle of a plane triangle, to construct it, when the rectangle under the line bisecting the vertical angle, and the difference of the sides is the greatest possible." *Burrow's Diary*, page 30, A. D. 1781.

He was repeatedly solicited to contribute to *Lebourn's Mathematical Repository*, but he does not appear to have done more, in his own name, than propose Ques. 153 in the first series of this extensive and valuable work. Altogether his contributions to the periodicals extend over a period of nearly sixty years, and though he was far from being so extensive a correspondent as Butterworth, there is scarcely a work of this description but had, at one time or other, either *publicly* or *privately*, a share of his support, and that generally in questions of the highest order of difficulty. About 1794 he became a member of the Oldham Mathematical and Philosophical Society, which, from the number of able geometers it has produced, may not unaptly be termed the *Lancashire School*. Ainsworth, Taylor, Mabbot, Hilton, Fletcher, Wolfenden, Butterworth, Kay, &c., are names which need only be enumerated to prove the importance and respectability of the association; and it may be added, that the vicinity at present contains some

"Worthy scions of most worthy sires,"

who *only require a proper channel through which to aid the reviving spirit* of the ancient geometry.

During the period just reviewed, Mr. Wolfenden enjoyed the correspondence of most of the leading characters of the day. Professors Bonnycastle and Lowry are said to have visited him in his seclusion, and to have expressed themselves much gratified with his instructive and interesting conversation; and it may be gathered from the following extracts from various letters addressed to him, how high he ranked in the estimation of the talented writers. It is much to be regretted that these few are the only remains of an extensive collection, the rest having been used by a grand-daughter to "wrap sweetmeats in."

No. I.

London, Sept. 21st, 1795.

Sir,—As I am now in a distant part of the country, I could wish to commence a regular correspondence with you, as it would be a means of informing me how the rest of my friends are, and to me a constant source of pleasure and instruction. The day after my arrival here, I introduced myself to Mr. Whiting;—a very modest and agreeable man he is. I dined with him the Sunday following. He has received a solution to that question of mine in the *Delights* from Mr. Lowry. I found Mr. Griffiths a few days after; he is with Mr. Lackington, the greatest bookseller in London. I was soon after admitted a member of a mathematical society consisting of upwards of sixty members. .... Mr. Sanderson, Isaac Dolby, Mr. Whiting, Hampshire, Edwards, Bickford, Griffiths, &c., are all members among whom I meet with a friendly reception. Most of these gentlemen remember you, but thought such a person *as you never existed*, but your writings had been by *some eminent person under a fictitious name*. Mr. Leybourn is publishing a periodical work,* and I think Sanderson examines the proof sheets. He told me the question respecting the exciseman's staff was reproposed in it; when it makes its appearance I will send you one.

Your well wisher,

JOHN FLETCHER.

Mr. Wolfenden,
Hollinwood.

No. II.

London, June 23rd, 1798.

Dear Sir,—When my friend Mr. Fletcher was in town last, he promised me he would ask you for a new question or two, one of them to be the Prize Question. He informed me you would send a solution to the last Prize, and that you had a solution to the question in the *Gentleman's Diary* about the Exciseman's staff. If you will send me a new question or two, and a solution to the Prize, I shall be very much obliged......

Give my respects to Mr. Fletcher when you see him.

I remain, your obliged servant,

WILLIAM DAVIS.

Mr. James Wolfenden,
Hollinwood.

*** This letter evidently relates to the *Gent. Math. Companion*, of which Mr. Davis was then editor.

No. III.

September 3rd, 1798.

Sir,—I should esteem it a particular favour if you will please to favour me with anything suitable for the *Repository*.

I am, Sir, your most obedient,

THOMAS LEYBOURN.

Mr. James Wolfenden,
Hollinwood.

*** This letter was written on the blank page of a circular announcing the publication of No. VI. of the *Repository*.

---

* *Mathematical Repository*. Old Series. The question alluded to was cancelled in the second Number.

No. IV.

Bolton, Nov. 4th, 1798.

Sir,— . . . , Please to present my most respectful compliments to Mr. Wolfenden when you see him. I consider myself as much honoured by the notice he took of me in his letter to Mr. Walker. . . . , I intend to buy the *Student*, which you inform me was published on the 1st instant. . . . . I am endeavouring to kindle a love for mathematics in this place, as far as lies in my power. . . . . . . I hope Mr. Hilton's removal to Liverpool will turn out to his advantage.

I am, Sir, your obliged friend,

JAMES CUNLIFFE.

Mr. John Fletcher,
Oldham.

No. V.

Taliaris, 4th Jan., 1799.

Sir,—Mr. Swale this day sent me a question from you for the use of the *Mathematical and Philosophical Repository*, for which you will please to accept my thanks. I have not yet received any question that pleases me for a Prize Question for the next Number. I will, therefore, be obliged to you if you will be so good as favour me with a very difficult question in physics or mechanics: I mean one that includes something of *forces*. This sort of questions are in your way, and I could wish you to form an article on this subject to contain curious and difficult questions as exercises. By this means you might be of great use to your brother mathematicians. . . . .

I remain, Sir, your most obedient,

THOMAS LEYBOURN.

Mr. James Wolfenden,
Hollinwood.

No. VI.

Chester, 26th Feb., 1799.

My dear Sir,— . . . . Mr. Leybourn, editor of the *Repository*, in his last letter to me, desired me particularly to write and solicit your productions for his work. He mentioned having written to Hollinwood, but had not received any reply. . . . . He would be extremely thankful for some good questions. There is one advantage attending Leybourn's publication, viz., *exemption from postage and thanks from himself*. . . . I have this day received the *Student*, No. II., but I have very little time to do much in it; perhaps I shall dispatch the geometrical questions—though I would wish to observe the 37th will not be done neatly by many. . . . .

I remain, Sir, your most obedient,

J. H. SWALE.

Mr. James Wolfenden,
Hollinwood

No. VII.

London, Sept 27th, 1799.

Dear Sir,—I received your very ingenious letter of the 18th ult., covering a very ingenious and elegant solution to the exciseman's staff question, and accompanied with a new question, for which you have my best thanks. . . . As I cannot think that a printed copy of these would be disagreeable to you, I have taken the liberty of enclosing one without having made any abridgment as you desired. . . . Send a solution to your question as soon as you can conveniently; indeed, the sooner the better, as it will give me an opportunity of considering and examining your remarks in that solution, which I hope will be given in that candid and true gentleman-like manner in which you have already begun them. . . . Give me a few solutions to some of the other questions. . . . . . You may find some of them worthy of your notice. . . .

I am, dear Sir, with great respect,

Your very obedient servant,

WILLIAM DAVIS.

Mr. James Wolfenden,
Hollinwood,

No. VIII.

Chester, February 12th, 1800.

Sir,—I am desired by Mr. Leybourn to request the favour of a solution to your question in No. 7 of the *Repository*. . . . I was happy to see your solution to the *old question* in the *Gentlemen's Companion*; but I have not yet had time to peruse it attentively. . . . I entreat you to favour me with a good geometrical problem for the *Repository* if you have any prepared.

Yours with respect,

J. H. SWALE.

Mr. James Wolfenden,
Hollinwood.

No. IX.

Liverpool, 28th October, 1800.

Sir,—From two letters I received from Messrs. Travis and Fletcher, I formed a hope, ill-founded it appears, that you would favour me with the result of your labours upon the question I wrote you concerning. I have waited with great impatience, and at no little expense, four or five days for it; but now hardly expect any answer. . . . The *Student* will be out some time next week, and a parcel shall be sent off for the Society at Oldham. . . .

I remain your most humble servant,

WILLIAM HILTON.

Mr. James Wolfenden,
Hollinwood,

No. X.

London, August 20th, 1801.

Sir,—In conformity with your request, I write to inform you how Mr. Davis is getting on with the *Companion*.... No solution has been given to yours. Edwards some time ago promised a solution, but he informed me last Sunday that he should only answer his own.... Mr. Davis will be ready for your solutions in about three weeks, and he hopes you will not disappoint him.... I have seen Mr. Wildbore lately, but the old gentleman showed a shyness which I attributed to something which inadvertently fell from me at Liverpool.... Seeing this, I forbore making any inquiries concerning the *Diary*, and he as studiously avoided saying anything.... Mr. Davis is extremely solicitous that you answer your own questions *at least*. With respects, I am, &c.,

John Fletcher.

Mr. James Wolfenden,
Hollinwood.

From the preceding it will appear evident that he was well known as an able mathematician, and also how very backward he was to appear prominently before the public. His immediate friends repeatedly urged him to apply for some public situation, and at last, yielding to their entreaties, he applied, through the agency of Mr. Fletcher, for the situation of Mathematical Master in the Royal Military Academy; but there was at the time no vacancy in that establishment, and he never renewed his application. Indeed, so strong was his attachment to home, that when he was offered a situation in Liverpool, he transferred it to Mr. William Hilton, who was then his pupil, and afterwards the talented editor of the *Student*. In 1807, Mr. Wolfenden calculated the first tide table for the port of Liverpool, which was published by Mr. Lang, in the "Original Liverpool Almanack" for the following year. The conditions were that he should receive 5*l*. for the first table, and *something additional* to that sum for succeeding years *if the work was found to pay*. The work *did pay*, and he continued to calculate the table up to the time of his death, *but for the last two years, when he most needed pecuniary assistance, the proprietors thought proper to lop off the additional fee*. In this work he proposed and solved the following problem:—

"Suppose the sun and moon in the equinoctial, and the ratio of their forces to raise the tides to be given, it is required to find *geometrically* their elongation, when the interval, or intercepted arc, between the place of high water and the moon is the greatest possible."

The solution is founded on the lemma to prop. 58, *Simpson's Select Exercises*, and shows how much can be effected by geometry when applied by a skilful hand. In a foot note he informs his readers that "Bernouilli and other writers on the theory of tides make use of fluxions in the investigation of this problem."

Mr. Wolfenden's time continued thus to be occupied, partly at the loom, and partly by private tuition, until his sixty-second year, when, in consequence of some disagreement with his employer, he relinquished hand-loom weaving and devoted the whole of his time to tuition. On this occasion he issued the following circular; a document, by the way, as simple and unaffected in its style and pretensions as were the life and habits of its author:—

"James Wolfenden, Private Teacher of Mathematics in Manchester and its vicinity, respectfully informs the public that he can at present engage a few more pupils, who may be instructed in Arithmetic, Geography, and the Use of the Globes, as well as the higher branches of Mathematics and their application to Mechanics."

From this period until he attained his eighty-sixth year, he continued to give instruction to various pupils in Manchester and the neighbourhood, some of whom at present occupy the highest rank in science, and whose *substantial* friendships ceased only with the death of their talented tutor. "In 1839," says Mr. William Lees, of Hollinwood—to whom, and to Mr. Henry Buckley, of Wood House, I am indebted for much of the preceding information—"I expressed a wish to see the late Mr. Butterworth, of Haggate, when Mr. Wolfenden, with his usual cheerfulness, said, 'I'll go with you, and introduce you to him.' Accordingly, the following Sunday we went, and it was truly gratifying to witness the interview between these aged and devoted sons of science. To hear them discourse on the writings of Newton, Simpson, and Emerson, and of the palmy days of the '*Companion*,' was

pleasant, indeed; *but, when each inquired of the welfare and prospects of the other, disclosures were made which force one to think that these men were deserving of better things.* At parting, Butterworth expressed a doubt of their ever seeing each other again, when Wolfenden replied, '*the probability was, that they would be inmates of Royton workhouse together.*' His circumstances were very low, indeed, so much so, as scarcely to afford the *commonest* necessaries of life. When, however, his extreme poverty became known to his friends and pupils in Manchester, they set themselves laudably to work in his behalf, and succeeded in raising, by subscription, a sum sufficient to purchase an annuity which would have supported him in comfort. But, alas! the assistance came too late, for 2*l.* were all that he received of it during his life, and when he died one of the sovereigns was still unchanged. When Mr. Hodgkinson, who brought him the money, pressed him to accept another sovereign, stating, 'that it was his, and had been collected for his own use,' he modestly declined, saying, 'that what he had received would be sufficient for the present.' And so it was, for he died the following Monday week, the 29th of March, 1841, aged eighty-seven years."

His character may be summed up in a few words. He has been described as possessing "a firm and independent mind, nor was he ever known to submit to any mean action: a great lover of truth, and sternly opposed to falsehood of whatever kind. His honesty and rectitude of conduct were such as to command esteem and respect from all who knew him." The tardy, though praiseworthy, assistance rendered to one so distinguished in science did not escape observation, and a paragraph which appeared in the *Manchester Guardian* two days after his death, stating that "in consequence of his great age and growing infirmities, a *few* members of the Literary and Philosophical Society of Manchester, and others, anxious to testify their admiration of his acquirements, obtained under such circumstances, had entered into a subscription to secure to him a comfortable subsistence for the remainder of his life," but that his death having rendered "their intentions towards him nugatory," "a part of the handsome sum subscribed will be appropriated to his decent interment, and to a suitable memorial to be placed over his grave;" appears to have roused the ire of one who desired to see more *timely* aid, and induced him to give vent to his indignation in the following effusion, dated 31st of March:

ON THE DEATH OF WOOLFENDEN, OF HOLLINWOOD, THE WEAVER AND MATHEMATICIAN.

Astronomers have taught us, there are stars,
Whose rays have reached not yet our nether world,
So far are they above us. What are these
But emblems of thyself, old WOLFENDEN?
Thy light was hidden unto all, save few,
In thine own generation: yet shall move
Onward in glory to eternity.
They who believe
In the soul's transmigration, well may think
In thee, Archimedes survived again,
So skilled thou wert in all the mystic signs
Of squares and circles!—angles to subtend,
Prove two and two *ar'n't* four; and that the whole
Is not a part; that nothing can at once
Be true and false; that there are lines which run
Nearer each other to eternity,
Yet never touch;—with other wonders, sure
Too much, by far, for common intellects
To compass.
Well! thou art gone
The way of all the earth!—thy body rests,
As doth thy busy brain!—Thou gatheredst up
Thy feet, and died in peace: obscurely died:
With poverty and ills encompassed round.
So many a sun of genius oft hath set:
Yet not behind a cloud! but cherishing
A sure and certain hope, that he should live
To after times, though in his days forgot;
A light that glimmered in a sepulchre!
Oh! sweet delirium in the cup of death!
Rest, rest, poor shade!
And be not angry. *They* have clubbed a purse,
And mean to bury thee! Then, o'er the spot,
'Scribe trines, and squares, and serpents in a ring,
Biting their tails! In life forgot; ne'er heed,
In death thus honoured!—And yet in thy day
They purposed help; but, ah! in hoary years,
Four score and ten well nigh; encompassed round
With poverty, infirmities, and griefs;
Had not yet found the fitting time to give!
Great God! deliver us from stony hearts!
And hypocrites, who purpose but to do
A deed of mercy: then on the house top
Go forth to blazon it!—Oh! modesty,
Equalled by such munificence alone!
Wouldst have 'em keep
Their lust? or come with offerings round thy grave?

His remains were interred in St. Margaret's church-yard, Hollinwood, and a stone bearing the following inscription marks the spot:—

"Where rest the ashes of the honoured dead."

"James Wolfenden, of Hollinwood, died March 29, 1841, aged 87 years. Born in a humble station of life, and compelled to toil as a weaver for his daily bread. Self-instructed he became a distinguished Mathematician, familiar with the writings of Simpson, Emerson, and the Ancient Geometers; an able contributor to the Diaries and other Mathematical Publications, and a student

of the works of Newton. A few members of the Literary and Philosophical Society of Manchester, with other individuals, anxious to mark their sense of acquirements like his, made under such unfavourable circumstances, raised in the year 1841, a sum sufficient to purchase an annuity for his support, but his death occurring shortly after, they determined, besides bearing the expenses of his funeral, to place this stone over his remains to perpetuate the memory of his name and merits."

Without offering any remark on the preceding inscription, it may be observed that the melancholy picture presented to us in the last days of Wolfenden is far too frequently a *faithful* representation of the *real* condition of many of the brightest luminaries of science; and though perhaps not *strictly* applicable to the present case (for he had a *few* friends worthy the name), yet in many, very many instances, the following lines by Charles Wesley, on the erection of a monument to the author of Hudibras, in Westminster Abbey, convey a moral too pointed to be omitted.

"While Butler, needy wretch! was yet alive,
No generous patron would a dinner give.
Behold, now he 's dead and turn'd to dust,
Presented with a monumental bust!
The Poet's fate is here in emblem shown:—
He ask'd for bread—and he received a stone."

They are here offered for the careful consideration of those from whom support and encouragement, in such cases, are due; nor will one iota of their pointed application be retracted, so long as such men as Wolfenden, Butterworth and Whitley, after spending their youth and exhausting their strength in the advancement of science, are suffered to perish in old age surrounded by all the miseries of neglect, disease and destitution.

THOMAS WILKINSON.

Burnley, Lancashire, April 21, 1849.

DESIGN OF A MARINE LOCOMOTIVE.

Respected Friend,—Although numerous improvements have been made, during late years, in the steam-engine, a great amount of speed has not been attained at sea. A steamer cannot be propelled at a much higher speed than the old stage-coaches on the common road, although engines of immense power may be used. That this has long been considered unsatisfactory is evident, from the numerous attempts which have been made by engineers to modify the system; every imaginable form of propeller has been tried; the engines have been made lighter; and the shape of the vessel has been improved; yet the principle has remained the same. Some of these improvements have, indeed, proved of great value in an economical point of view; but they have not produced any great increase of speed. A steam-vessel, in ascending a river against the stream, makes but little progress, however powerful her engines may be. In America, the steamers ascend the rivers at the rate of only four miles per hour; a fact, which may well lead to the inquiry, whether the present mode of adapting steam to navigation may not be changed with advantage?

It is now several years since I gave some attention to this subject, and the result of my investigations has been my arriving at the conclusion, that a far greater speed can be attained at sea than by the present mode—a speed approaching to that already attained on land. Of course, under favourable circumstances, with the advantage of considerably less danger, as the vessel which I propose to construct would be as safe as a life-boat.

The principle on which a vessel is propelled on the water is, in some measure, analogous to the sledge; it is a straight body, moving on a level; or, to carry the comparison further, if a locomotive were made to draw a train of carriages, which, instead of being furnished with wheels, rested on bars of iron, sliding on the rails, we should have a specimen of the obstacles which a vessels encounters on being propelled through the water. Or, if a locomotive could be constructed on the same principle, that is, resting on bars of iron, the propelling power being applied to paddle-wheels, whirling round in a canal, placed on each side of the railway, we would have a more perfect illustration of steam navigation as it now exists; for the friction produced by the sledge-formed bars would scarcely be greater than is encountered by a vessel deeply immersed in the water.

Almost every engineer who has paid any attention to the subject, appears, to have concluded, that the improvements must be made in the steam-engine, and in the propeller, and that the vessel

itself must retain its present form, while it is evidently the form of the vessel which is the great obstacle to increased speed; for, although various forms of steam-engines and propellers have been tried, the direct action engines and old paddle-wheels retain their superiority over every other tried plans; the rotary engines and screw propellers have completely failed;* the latter being useful only as an auxiliary power to the sails, while those steamers which are remarkable for having attained a high speed, have a very light draught of water,—a fact, which may go far to prove that future improvement must be made in the vessel itself.

When a vessel is floating on the water, it is put in motion by paddles whirling on each side; the vessel itself possessing no power of moving, except what is imparted to it by the paddles. By this process, it must be evident, that a large proportion of the power used is lost in overcoming the friction produced by the vessel resting against a large surface of water, as the weight of water constantly displaced is equal to the weight of the vessel itself. The vessel having to cut through the water, the principle of propulsion on the water is, therefore, very different to that adopted on land, for in applying steam to railway propulsion, the power is applied direct to the locomotive itself; hence the immense speed which has been attained by this mode. It seems, therefore, that the true form for propulsion is a sphere rolling on a plane. The question is, whether this principle can be applied on the water; and, in order to prove the possibility of so doing to advantage, permit me to suggest a simple experiment on a small scale. Let a hollow metal globe be placed on the water, and it will be found that a slight touch will cause it to turn on its axis, and propel it at the same time; but, let the hand be lightly immersed in the water, and rapidly drawn across, the fatigue will be so great, that the experiment cannot be repeated many times. This may illustrate the principle of steam-navigation; the vessel cuts through the water; the globe rolls over it. Of course, if we could place a steam-engine in a large globe, so as to cause it to turn on its axis, we may conclude that it would be propelled on the water at a rapid rate; but, I am not going to propose the adoption of this plan for practical purposes. Nevertheless, strange as such a vehicle would appear at sea, of 600 feet in diameter, it would hardly be more so than a planet whirling in its orbit. And here permit me to ask those who may think of such a mechanical phenomenon with a smile, whether it is not probable that the planets move on a principle somewhat analogous? For, we can hardly conclude, that those bodies consist solely of an inert mass, moving entirely through the attraction of the sun? Is it not probable, that some power exists in the centre, which causes their motion? A power undoubtedly unknown to us, but which may be identical with what has been formerly denominated *central heat*. I must leave this subject however for examination by some modern Newton, and return to my proposed improvements in steam-navigation.

I may, however, here, by the way, offer a hint to those who believe in the possibility of navigating the air; they have all imagined that the form of the balloon might remain nearly the same; but that some propeller is required to put this large globe or cylinder in motion; while the fact is, that the only chance of success lies in causing the globe containing the gas to revolve on its axis. I am far from imagining, however, that this, of itself, would produce any great result, as the propelling power has yet to be discovered; for it will be easily understood, that a powerful machine would be required to cause such a globe to revolve with great rapidity, in order to attain a high speed. I mention this rather with a view of proving the nature of the obstacles which have to be encountered, before success is attained—a consummation of which, I must confess, I am entirely sceptical.

In order to adopt the rotary principle for steam navigation, I would propose to construct a vessel, which I call *The Marine Locomotive*. It would consist of six hollow metal globes, connected in pairs by means of axles, and all combined together by means of rods and cranks. Sufficient space would be left between each pair of globes to suspend a platform under the axles, on which the engines, &c., would be placed. This

* When and where? We think this statement admits of very considerable modification. Ed. M. M.

platform would be thus suspended sufficiently over the water to prevent its being immersed in ordinary weather, the height above the water being in proportion to the diameter of the globes. As this platform would not be perfectly flat, and would be covered over with a kind of metal vault, the vessel itself, a space for engine room, berths, &c., would be nearly of the form of an oval tube suspended by means of bearings to the axles—the axles passing through this tube—so that this might be termed a vessel without keel, deck, or masts. The power of the engines would be applied direct to the axles of the globes, which, for want of a better name, I would call the *floating wheels;* and these wheels being all connected, would revolve at once at the same rate. And thus this vessel would be propelled on the water on the same principle as the locomotive on land. It will be readily understood that, to ensure success, the main points to be attended to in the construction of such a vessel are strength and lightness, as a light draught of water is indispensable for speed. This end might be attained by constructing it of copper and gutta percha; the floating wheels might be protected from injury by being covered with the latter substance. Kamptulicon, which is a compound of India rubber and cork, might be also used with advantage; in fact, the wheels might be entirely covered with this substance, as it is extremely light. A marine locomotive constructed on this plan would be amphibious, and might be used with advantage in the Polar seas, as it might be propelled on a field of ice, and at any time be restored to its first element. Such a vessel could be easily run on shore on a level beach without injuring it; so that numerous advantages may be obtained by adopting this mode of steam navigation.

As I am at present explaining the principle of this invention rather than the details, which would require several engravings to illustrate, I will merely allude to a few of its distinguishing features. The floating wheels should not be immersed more than one-sixth of their diameter, and, as no paddle-wheels would be required, they might be furnished with small fans placed around their circumference in an oblique direction, in order to obtain sufficient hold of the water in revolving. It would not be essential that they should be constructed exactly of a globular form; they might be made nearly of the same form as paddle-wheels, but round as far as water-mark, and perfectly flat from water-mark to the axle shaft. A metal flange should be fastened round the circumference in the centre; this flange would answer the purpose of a keel in keeping the vessel steady, and preventing its drifting when not propelled. Another floating-wheel should so be placed at the bows, and another at the stern; but these should not be of the same form as the other, but narrow and wedge-shaped, although of the same circumference. They would, of course, be made to revolve, and either might be so arranged as to be used as a steering or guiding-wheel. Each globe should be covered with a thin metal covering, to protect it from the waves; and as the whole vessel would be covered over, the waves might break over it without injuring it, as its buoyancy would prevent it descending much below the surface, as an ordinary vessel does, which it is well known is frequently quite immersed under water, the masts alone being visible. I think it possible to combine, in the marine locomotive, the highest speed with the safety of the life-boat.

It is well known that the Venetian gondola is propelled on the water at a very rapid rate, which I believe is attributable to its peculiar form; the centre alone touches the water, and it bounds over the water with very little power being applied to the oar, which is simply used at the stern. Now, each globe of the marine locomotive may be considered as a gondola, with the advantage of revolving instead of gliding on the surface.

I hope I have stated sufficiently to explain the principle of this invention, which is, of course, susceptible of a vast number of modifications, some of which I might here explain; but as I have stretched my remarks at a great length, I must reserve further comments for a future communication.

I remain respectfully,
JOHN DE LA HAYE.

Liverpool, 4th mo. 23rd., 1849.

PASSENGER LUGGAGE LABEL.

(Registered under the Act for the Protection of Articles of Utility. John White Little, of Bath, Proprietor.

Fig. 1.

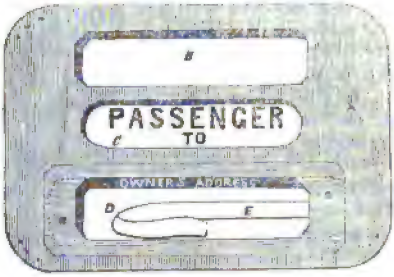


Fig. 3.

Fig. 2.

Fig. 1 is a top plan of this label. A, is a thin plate of gutta percha, or other suitable material, to the back of which there is pasted a piece of paper or parchment. B, C, D are three oblong slots, which are cut through the gutta percha, but not through the paper or parchment. On the parts of the paper or parchment exposed to view by the slot, B, there is written or imprinted the name of the owner of the luggage; on the part under the second slot, C, the words "Passenger To," and on the part under the third slot, D, the "owner's address," that is, his usual place of residence. Within the third slot, D, and immediately over the owner's address, there is inserted a folded slip of paper, on the folds of which are written or imprinted in succession the names of all the stations on any given line of railway, and with that fold placed uppermost which exhibits the particular station which the owner of the luggage is a "Passenger To." A view of this station slip, in its folded state, is given separately in fig. 2, and another view of it, partially extended, in fig. 3. The two ends of the folded slip take into hollow recesses, *a a*, formed in the ends of the slot, D. E is a parchment riband, interposed between the "owner's (real) address" and the station address slip, in order to facilitate the taking out of the latter when necessary—one end of it being made fast within one end of the slot, D, and the other left free.

The label is attached to the box or bag either by wires, nails, or sewing, for which purpose there are holes perforated in it at the four corners.

WHITE'S CHIMNEY-POT, OR VENTILATOR.

[Registered under the Act for the Protection of Articles of Utility. George White, of Jersey, Master of St. Mark's School, Proprietor.]

Fig. 1 is an external elevation of this chimney-pot; fig. 2 is a plan; and fig. 3 an elevation partly in section, taken on the line *a b* of fig. 2.

A is the body or base of the pot, which is of the form of an inverted frustrum of a cone. B is a hood, which is affixed to the top of the body, A; the lower edge

Fig. 1.

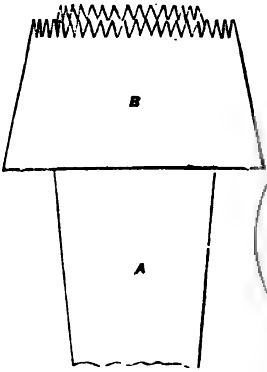


Fig. 2.

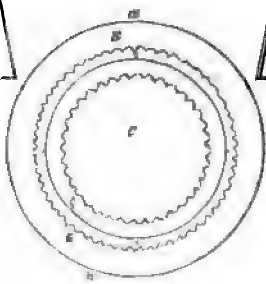
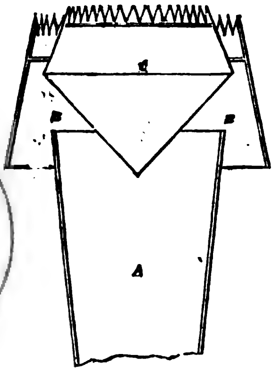


Fig. 3.



of the hood falls some distance below the upper edge of the body. C is a conical-shaped top, which is affixed to and carried by the hood, B, and occupies a central position as regards both A and B. The annular space between the hood, B, and top, C, must be of nearly the same area as that of the body, A, to admit of a free passage to the ascending column of smoke or air, according as the article may be used as a chimney-top or ventilator.

The novelty of the apparatus turns on the employment of the conical-shaped top, C, which is certainly a very good contrivance. We have received highly favourable accounts of its performance in a most exposed locality.

BROWN'S IMPROVED TILE AND PIPE MACHINE.

(Registered under the Act for the Protection of Articles of Utility. Michael James Brown, of Oundle, Northamptonshire, machine maker, Proprietor.)

Fig. 3.

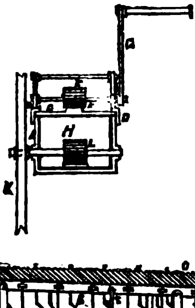


Fig. 2.

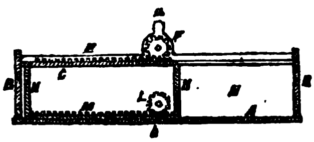


Fig. 1.

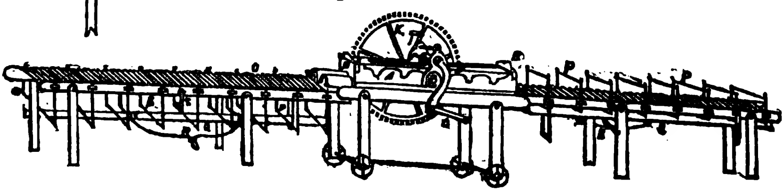


Fig. 1 is a perspective view of this machine in its complete state; fig. 2, a longitudinal section of the clay chambers; and fig. 3, a cross section on the ine *a b* of fig. 2.

AA is a trough or box, which forms chambers for the reception of the clay to be moulded; BB are the two ends, which are perforated or otherwise cut out so as to form a die or mould for the clay to be pressed through; C is a cover, which is a little more than half the length

of the trough, A; it slides in grooves formed by pieces of angle iron, D D, attached to the sides of A, and can be pushed to either end at pleasure by means of a rack, E (which is fixed upon its upper side), the pinion, F, and the crank handle, G. H H are two square plates, which accurately fit the trough, and form pistons, which press the clay through the end plates or dies. The power requisite for this purpose is applied to the handle, I, attached to one of the arms of the fly-wheel, K. L is a pinion on the fly-wheel shaft, which works in a rack, M, cast either in one piece with the pistons, H H, or securely affixed to them.

In fig. 2 the parts are represented as being in the position they would occupy previous to filling the chamber, N, with clay. When that chamber is filled (which is done by hand), the sliding cover is pushed along by the handle, G; power is then applied to the handle, I, which causes the clay to issue through the perforations or dies in the end plates, on issuing from which the moulded materials are received upon the rollers, O O. P P are two sets of cutting frames, attached to the horses carrying the rollers, O O. The one set on the right hand is represented as being up and ready for cutting the moulded materials into lengths; the other set is shown as being down. Each set of frames, P P, is attached to a horizontal bar, Q, which is raised up by the handle, R. When up, the handle, R, rests upon a catch, S; the moment that handle is liberated, the weight of the frames and the parts attached to them are sufficient to cut the whole line of pipes or tiles into lengths.

EMPLOYMENT OF BALLOONS IN MILITARY SURVEYING.

Sir,—As the subject of balloons has frequently been discussed in your Journal by many intelligent correspondents, I should feel extremely obliged to you if you would insert the following queries in one of your Numbers, and solicit the favour of answers to them, with such remarks as the writers may be kind enough to add. My object is to ascertain the practicability and cost of employing balloons as a means of reconnoitring the enemy's works and position in our Indian warfare.

1st.—What would be the cost of a balloon sufficient to carry one or two engineer officers to an elevation of a few feet, the balloon being held down by ropes, or as it is termed, a *captive balloon?*

2nd.—Could it be raised, to be useful, in any but a day perfectly calm, so as to remain stationary at the proposed elevation, and admit of the party in the car making observations with his telescope? The ropes might be fastened to a field-piece, and by this means the balloon might be moved from place to place.

3rd.—How should the gas be obtained for inflating the balloon; and what would be the cost of the apparatus? It is presumed that a small furnace with retorts for the decomposition of water would require more than one or two ammunition tumbrils for its conveyance.

4th.—What time would be required for the inflation of the balloon with a portable furnace of small dimensions?

5th.—Once inflated, how long might it be kept in that state?

6th.—The French are understood to have employed balloons in the early part of the revolutionary war, and also to have sent them with the army that invaded Egypt. Were they successful; and what led to their discontinuance afterwards?*

7th.—Have captive balloons been employed in England for purposes of meteorological science?

8th.—With the improvements which have been made of late years in the manufacture of caoutchouc, gutta percha, &c., would not a superior material now be available for balloons; and could they not be easily constructed or repaired in

* It is stated in the article AEROSTATION in *Rees's Cyclopædia*, that to the information which the French obtained by means of ballooning, they ascribe the great victory gained at Fleurus in 1794. The balloon employed on that occasion was called the *Entreprenant*, and was under the direction of M. Coutel, the captain of the aeronauts at Meudon, who, accompanied by an adjutant and a general, ascended twice on the same day to the height of 220 fathoms for the purpose of observing the position and manœuvres of the enemy. He continued each time four hours in the air, corresponding with General Jourdan, who commanded the French army, by means of preconcerted signals. A battery was opened by the enemy against the ascending aeronauts, but they soon gained an elevation beyond the reach of their fire. We think the subject well-deserving of renewed consideration, and recommend the inquiries of our correspondent to the attention of our readers.—ED. M. M.

India, where the heat of the climate may be injurious to the article?

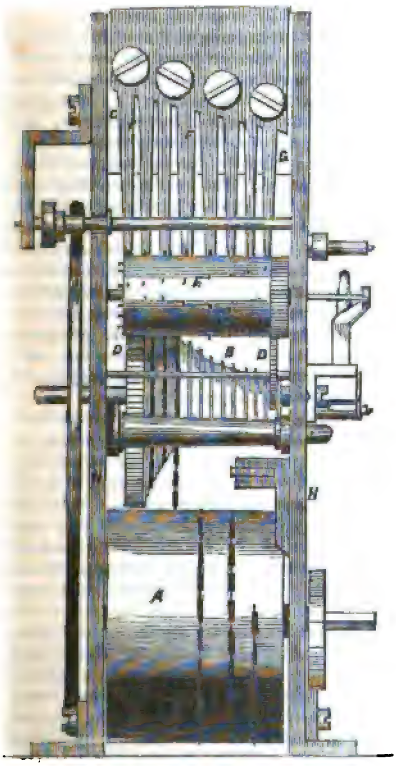
9th.—The objection that the aëronaut could be exposed to danger by a shot from the enemy striking the balloon—a very unlikely accident, as it could always be kept out of the range of their guns—appears not to have much weight. Besides a parachute attached to the car would insure a safe descent.

I remain, Sir, yours, &c.,

A Bengal Civilian.

Edinburgh, April 24, 1849.

PAYNE'S PATENT MUSICAL CHIME CLOCKS.



In all chime clocks as hitherto constructed, the chimes have been produced by means of *bells* struck by hammers, put in motion at stated times by means of trains of wheels, springs, racks, &c., but the multiplicity of the requisite machinery, and the space occupied by it, have caused such clocks to be expensive and cumbrous, and consequently but little used.

Mr. Payne, of Bond-street, has just patented a very ingenious substitute for the bell, by which, not only are these objections entirely obviated, but much finer sounds or chimes produced. The prefixed figure is an end elevation of the striking parts of a clock exhibiting Mr. Paine's improvement.

A, is a spring barrel. B, a fusee which is connected with the barrel by the chain, C. D D, a train of wheel-work giving motion to the barrel, E, which latter is studded with sets of pins similar to an organ barrel, and arranged so as to produce the proper chimes by acting on a set of steel springs, F F, which are attached to a cross-bar, G, which is made either in one piece with the framework, H H, of the clock, or secured to it by accurate fitting screws to prevent any jar in the sound of the springs.

The means employed for causing the barrel, E, to rotate at the proper intervals of time are exactly similar to those employed in clocks fitted with bells, and being well understood, do not require to be here further explained.

SMOKE RESPIRATOR.

Sir,—In reply to the strictures to which Mr. Baddeley has subscribed his name (see *Mech. Mag.*, No. 1339, p. 322), evidently for the purpose of opposing the introduction of the new Smoke Respirator of Messrs. Robinson and Siems, I beg, as one who was actually present at the experiments, to offer a few remarks.

I can testify, in the first place, that it was never given out that the invention was to be produced for inspection; all that was promised was shown, as described in your pages, No. 1338, p. 305; and I think it most unjust that the inventors, Robinson and Siems, should be sneered out of their property, because Mr. Baddeley, and perhaps a few others, are envious of the success of these persons in solving the riddle, "How can we live in smoke?" Mr. Baddeley, it is quite evident, is not in possession of the secret of placing the egg on its end. As for his theory of chemical absorption it is as ridiculous as the assertion that water has been found fully adequate for the purpose. Mr. Baddeley evidently knows nothing of the subject, further than that a miner of the name of Roberts invented, twenty-five years ago, a sort of diving-bell for smoke, for which he was duly rewarded, as Mr. B. circum-

stantially relates. But this smoke diving-bell, with all its encumbrances of breathing-hose, &c., has not become generally useful. Nor does it in the least resemble the invention of Robinson and Siems, which is portable in a small pocket, and costs but a few shillings, while the other costs many pounds.

Simplicity is its great merit; and as for efficacy, Mr. Baddeley's superficial logic has not in the least disproved the real merit of the new invention first described and approved in the *Mech. Mag.*, No. 1338, p. 305. I am, Sir, yours, &c.,

N. H. PHILLIPS.

16, York-terrace, Camberwell New-road.
April 23, 1849.

[The "being actually present" at an experiment does not, it is plain, involve of necessity any peculiar capacity for understanding and appreciating it. We hope for the sake of Messrs. Robinson and Siems that the originality and usefulness of their invention, admits of some better vindication than this.—ED. M. M.]

MR. C. B. MANSFIELD'S PATENT BENZOLE VAPOUR LAMP.

[Abstract of a Paper by Mr. Mansfield, read before the Institution of Civil Engineers, 17th April, 1849.]

Liquid hydrocarbons have been comparatively little used for the production of artificial light; and in the instances in which they have been applied, their liquidity, and not their evaporability, has been turned to account.

In the use of the common volatile oils, the excess of carbon in their composition is the great difficulty; this, however, when properly treated, becomes an actual benefit.

There are two methods of rendering this carbon efficient as "light-fuel," when advantage is taken of the volatility of the substances: one is, to cause the vapour, as it escapes from a jet, to mix rapidly with the air; the other, to mix the vapour, before combustion, with other gaseous matters containing less carbon. The first of these methods is instanced in Holliday's recently patented Naphtha Lamp. The second is adopted in the new arrangements about to be described.

According to one of these arrangements, the hydrocarbons are mixed with some other inflammable spirit containing very little carbon. The mixture is made in certain definite proportions, which ensure a perfectly white light, and from which any deviation results in a flame of inferior quality,—pale, if the hydrocarbon be deficient, —smoky, if the mixture be poor in spirit. The ingredients most accessible in this country, are wood-spirit and a volatile oil from coal naphtha, in the proportion of two-thirds of the former to one-third of the latter. Alcohol and oil of turpentine have been similarly used on the continent, though the former is too dear for use in England.

Another adaptation of the same principle is, the solution of the hydrocarbon vapours with permanent gases of inferior, or even of no illuminating powers.

This application may be called the naphthalization of gas, or the gasization of naphtha, according as its main object is to enhance the services of the gas, or to utilize the liquid: the latter was the object of the new proposal which forms the subject of this paper. The former has been already accomplished by preceding inventors.

The first invention was that of Mr. Donovan, in 1830, who proposed to confer illuminating power on gases that were inflammable, but not luminiferous, by charging them with the vapour of hydrocarbons; but from the want of a sufficiently volatile fluid, he was compelled to have a reservoir close to every burner. The next application was that of Mr. Lowe, who increased the light obtained from coal gas by passing it over surfaces of naphtha. Mr. Beale's air light followed; its object was to use hydrocarbons for illumination, by passing a current of air through vessels containing those liquids. There existed, however, the same obstacles to this plan as to that of Mr. Donovan, viz., the heat required to evaporate the only liquid hydrocarbons then accessible.

At length the difficulty has been solved, by the discovery of a liquid hydrocarbon, as volatile as spirits of wine, but containing sufficient carbon for the most perfect light, and obtainable in any quantity. This hydrocarbon is procured from coal tar, and called "Benzole." Its volatility is such as to enable it to naphthalize atmospheric air as effectually as ordinary naphtha does coal gas.

The system proposed by the author consists in conducting a stream of almost any gas, or even of atmospheric air, through a reservoir charged with Benzole or some other equally volatile hydrocarbon; the gas or air so naphthalised being then conducted like common coal gas through pipes to the burners. The system is applicable on any scale, from the dimensions of town gas works to the compass of a table lamp. [An apparatus was exhibited to the meeting, in which a small gas-holder, filled by a pair of bellows, supplied common air through pipes.] The gases formed by passing steam over red-hot coke would answer well for this purpose, and it would depend on local circumstances

whether this mode of generating the current would be preferable to the expenditure of the mechanical force necessary for driving atmospheric air through the pipes. Pure oxygen charged with the vapour would explode on ignition; this might prove, therefore, a useful source of motive force. It is, however, difficult to form an explosive mixture of the vapour with common air. By decomposing water with the voltaic battery, naphthalizing the hydrogen with Benzole, and burning it with the aid of the equivalently liberated oxygen, a simple light of intense power may be obtained. This is a great simplification of the ordinary system of gas-lighting, as no retorts, refrigerators, purifiers, or meters are required, and the products of combustion are as pure as those from the finest wax. It may be expected that the elegance of the material and the simplicity of the apparatus will gain for it introduction into buildings and apartments where coal gas is not now considered admissible.

The apparatus and conditions necessary for the success of the method are, a flow of cheap gas, or of air, driven through pipes by any known motive power, and a reservoir of the volatile spirit, through which the main pipe must pass in some convenient part of its course; these pipes and reservoirs being protected from the cold. Though the liquid does not require to be heated above the average temperature of the air, it is liable to become cooled by its own evaporation, so as to require an artificial supply of warmth. This is readily effected by causing a small jet of flame of the gas itself to play upon the reservoir; and by a simple contrivance, called a "Thermostat," by which the flame is shut off when necessary, the temperature can be made self-regulating, so as never to rise above or fall below a proper degree. The cooling due to the evaporation would, of course, be inversely proportionate to the quantity of liquid in the reservoir. If atmospheric air were used as the vehicle for the vapour, the jet holes in the burner, from which it escaped for combustion, must be slightly larger than those for coal gas. [Some burners, contrived for the purpose of accurately adjusting the size of the orifice to the quantity of luminiferous matter escaping, were here exhibited and described; they were made so that by moving a part of the burner, any required quality of flame, from lightless blue to smoky, could be obtained, there being a medium point at which the most perfect brilliancy is arrived at.] The burners would answer equally well for coal gas, though that material could not, even by them, be made to evolve so white and pure a light as that from Benzole vapour.

A gallon of Benzole, of the degree of purity requisite for the purpose, costs about two shillings and sixpence; to this, the expense of the air current and the interest of the original outlay on apparatus must be added. This, it is presumed, would not raise the cost to more than four shillings for the consumption of a gallon of Benzole. Now, one ounce of that liquid will give a light equal to four wax candles, of four to the pound, for one hour; or one gallon for about one hundred and twenty hours. And hence it follows, that a gallon of this material is equivalent to about one thousand cubic feet of coal gas.

Again; while to produce one thousand cubic feet of gas, at least two hundred pounds of coal have to be transported from the mine, one gallon of Benzole does not weigh more than seven pounds; this, in carriage, would give Benzole an advantage of twenty-eight to one over coal as a source of light.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING 26TH OF APRIL.

Joseph Eugene Asaert, Lille, France, machinist. *For improved means of obtaining motive power.* Patent dated October 10th, 1848.

This "new" contrivance for obtaining motive power is, as the intelligent reader will soon perceive, a very old acquaintance. It consists of a frame-work, in which are supported, in suitable bearings, two wheels, which carry an endless vertical chain or band, furnished with a number of projecting brackets for carrying weights. A second pair of wheels, of larger diameter than the first, are similarly supported in the frame-work, and carry an endless vertical chain or band fitted with a less number of brackets than the other. Underneath all these is a horizontal endless band, furnished with projections, and turning upon two wheels. The rotary motion of the top wheel of the first pair is communicated to the bottom one of the second pair; and hence to the undermost one by the intervention of suitable toothed and bevelled gearing. And this rotary motion is produced, in the first instance, by the weights falling from a source of supply on to the brackets of the first endless band, which is thereby made to descend, and its wheels to revolve. The weights, when they descend to the bottom, fall from the brackets, and are received between the projections of the horizontal band, and thereby carried to the second band, which receives them into its brackets, carries them up, and returns them to the source of supply. Two toothed rods are provided, which alternately gear into toothed wheels fixed upon the axles of the

second pair of wheels, and by their weight aid in the ascension of the band. Guides are placed so as to retain the weights in their proper positions, and the motive power resulting (?) from the revolution of these wheels is given off from their axis.

Claim.—The mode of combining mechanical parts into a machine, so that a pair of endless chains or bands may be caused to move by a series of weights; the descending weights being at all times more numerous, and acting with less leverage than the ascending weights, whereby (?) an improved means of obtaining motive power is produced.

Robert Angus Smith, Manchester. *For improvements in the application and preparation of coal tar.* Patent dated October 19th, 1848.

These improvements consist in the preparation and application of coal tar to coating the interior surfaces of water-pipes. The coal tar is first reduced by distillation or otherwise, to a thick, pitch-like mass, and placed in an open vessel, of sufficient depth, to contain the pipes to be operated on, where it is heated to 300° Fahr., or to a temperature at which the coal tar becomes fluid. The interior surfaces of the iron pipes are freed from oxide, and covered with linseed oil, to facilitate the adhesion of the coal tar in which they are immersed for about an hour, after having been previously heated to 300° Fah. When the pipes are lifted out, linseed oil is poured into them, which removes any excess of coal tar, and serves, at the same time, to keep the contents of the vessel fluid. Or, the pipes may be placed cold, after being cleansed from the oxide in the melted coal tar, and kept there until they are of the same temperature, which the patentee states he has generally found to take an hour and a half.

Claim.—Coating the interior of water-pipes with coal tar by the aid of heat.

Samual Cunliffe Lister, Manningham, York, gentleman. *For improvements in preparing, heckling, and combing wool and other fibrous materials.* Patent dated October 19th, 1848.

1. To scour the wool or other fibrous materials, the patentee makes use of a vessel 12 feet long, 3 feet wide, and 3 feet deep, containing soapsuds or other scouring liquid; and, beneath the water line, a roller supported in bearings in the sides. Above the vessel are two pairs of rollers, carrying two endless bands of net or other material, which pass underneath the submerged roller. The bottom band supports and carries the wool, and the top one keeps it in position by lightly pressing upon it. In order to insure an equable motion, the edges of the band are attached to endless chains, to which rotary motion is communicated, whereby the band is drawn through the water, under the submerged roller, and out of it, and finally delivered to a pair of compressing rollers, which finish the operation.

2. The wool is prepared for combing, that is to say, has the staples taken out, and the fibres parallelized, by being made to pass between a wooden roller, fitted with projecting pieces upon its periphery and a porcupine roller, which is furnished with lifting bars placed between the teeth. The projecting pieces take into the spaces between the teeth, so as to cause them to enter the wool at right angles, and the ends of the lifting bars travel in eccentric guides or races, whereby the wool is lifted off the teeth to a pair of ordinary rollers, and thence on to another porcupine roller similarly arranged to the first. Instead of the ends of the bars being made to travel in an eccentric race, and the wool lifted off the teeth, the teeth may be withdrawn from the wool, and the race dispensed with, by the foundations of the teeth being placed upon springs in recesses in the periphery of the roller, so as to allow of their being depressed when necessary, by the action of projection pieces suitably arranged, whereby the teeth are withdrawn. Or, the wool may be drawn between a pair of porcupine rollers, or between a pair of porcupine endless bands. These processes are similar to those patented by Mr. Perry and by Mr. Donnisthorpe respectively, for combing wool and heckling flax, with the addition of feeding in and feeding off rollers, which produce the square motion before described.

3. The patentee proposes to vary the pitch of the worm of the screw gill, so that one end may be as large again as the other, in order to produce a progressively increasing motion, whereby a draft is created between the combs entering the wool and those leaving it.

4. The front rows of the combs are made shorter by more than half an inch than the back ones, which rob the wool from the rollers, and hold and prevent the noil and trash from passing with the good wool.

5. For combing, an apparatus is employed, in which a square motion is given to the combs, by means of top and bottom guides in which they slide. Underneath the frame is a revolving shaft, which carries two cams with inclined faces. The action is as follows:—one cam lifts one of the combs from the bottom guide-frame into the top one, and the inclined face causes it to travel a distance therein equal to its breadth; the second comb is lifted up and pushed forward in like manner, and so on with all the combs, until the first arrives at the end of

the top guide, when the second cam allows it to fall down into the bottom guide, and pushes towards its first position.

Claims. — Carrying or supporting wool through soapsuds or other scouring liquids by means of endless sheets or bands.

2. The lifting bars to assist the wool in drawing from porcupine rollers, drums or sheets, either for preparing the wool to be combed, or after it is combed.

3. Using porcupine sheets or aprons, with or without lifting bars, so long as the wool is not allowed to accumulate.

4. Preparing wool to be combed upon a machine wherein a motion is produced, similar to that of a screw gill, (but without a screw,) that is to say, the teeth are caused to enter the wool at right angles to the fibres.

5. Preparing wool upon porcupine surfaces, to be combed by hand.

6. The patentee remarks, under this head, that he does not claim the patented plan of Mr. Perry for combing wool, nor that of Mr. Donnisthorpe, for heckling flax, except when rollers are used to feed the wool on and take it off.

7. Constructing screw gills with a varying pitch, so that a draft may be created between the gills entering the wool, and those leaving it.

8. Arranging sets of combs in such manner, that some of the back ones may not be less than half an inch longer than some of the front ones.

9. The machine, before described, for combing wool; the working of which is very similar to that of a screw gill, (but which has no screw,) the teeth entering the fibres at right angles, and travelling in it in a horizontal direction or nearly so.

Frank Clarke Hills, Deptford, Kent, manufacturing chemist. *For improvements in treating certain salts and gases or vapours.* Patent dated October 9th, 1848.

1. The first of these improvements consists in certain processes and apparatuses for increasing the illuminating power of gas, and obtaining a greater quantity of gas from a given quantity of coal.

The tar or pitch resulting from the manufacture of ordinary coal gas, is deprived of its naphtha, and reduced, by distillation, to a hard and solid state when cold. After this, it is melted and mixed with breeze, small coke or coal, when it may be, to produce gas, distilled in a retort by itself, or mixed with coal, or thrown in on the top of a charge. Or, the thick tar may be run, in a gentle stream, into a vertical retort, kept red-hot, and partially filled with coke, whereby gas will be generated, and more coke formed, which must be removed when the retort becomes too full. The gas passes over the heated surfaces of the coke, and escapes from the bottom of the retort. The retorts employed (by preference) for this purpose are "reciprocating ones," that is to say, retorts in which the gas of the one is made to pass into the coke of the other. The vapour of naphtha, which is distilled from the tar, may either be condensed, by being caused to pass through a refrigerator, or converted into an illuminating gas, by being made to flow into a red-hot vertical retort, partially filled with coke. The illuminating quality of the gas may be much improved, by being mixed with the waste gas of wood, which is evolved in the distillation of pyroligneous acid.

2. In order to obtain, in a concentrated state, volatile solutions of ammonia, Mr. Hill proposes to employ a tower, ten times greater in height than in diameter, and fitted inside with iron trays placed about two feet apart. The spaces between the trays are nearly filled with coke, broken tiles, and other such like suitable materials. And the solution is caused to flow into the top of the tower, and through these various substances, while a current of steam or heated air is drawn in at bottom by means of a chimney or other suitable mechanical means, so that it may come into contact with the solution, percolating the media, and thereby vaporise the ammonia, and allow the water to flow out at bottom. The ammoniacal vapour is next led through similar media, which surrounds a coil of pipes, placed in a second tower, to conduct the solution to the first. By this arrangement the ammoniacal vapour will communicate portions of its heat to the solution, and consequently lose the greater part of whatever watery particles it may retain after the first operation.

3. To concentrate saline solutions and sulphuric acid, a process is adopted very similar to the preceding, with these modifications, however, that the towers are lined with some substance not affected by the acid, and the media employed possess also the same acid-resisting property.

4. Liquids are made to absorb gases, which have an affinity for, or are soluble in them, by being caused to flow into the top of a tower like the one before described; but, having saw-dust, tan, or pumice-stone, as the percolating media, and the holes of the tray sufficiently small to prevent their falling through, while the gas is drawn in at bottom, and penetrates the saw-dust, and combines with the liquid with which it is saturated. Or, the gas may be conducted into a horizontal cylinder, half filled with the liquid, and furnished with a horizontal spindle, surrounded with brushwood, furze, or other similar substances. Rotary motion

is communicated to the spindle, and the brushwood, dipping half into the water, carries up some of the particles, which, falling from point to point, become saturated with the gas. When the liquid is sufficiently impregnated with the gas, it is drawn off, and a fresh supply introduced.

5. To expel the noxious gases or vapours from vessels in which ammoniacal liquids have been saturated, as also from gas-purifying materials, and the vessels containing them, currents of steam, or atmospheric air, either heated or not, are passed through them. The draft is created by a chimney or other exhausting apparatus, and the steam or air is admitted at top of the vessel, and drawn down through the material to a chimney. In case the vessel or purifying material contains a gas which it may be desirable to preserve, a condenser may be placed between it and the chimney. By this process the lime used in gasworks may be so purified as to be fit for use again. And the formation of explosive compounds by these gases is prevented by causing a sufficient quantity of steam or atmospheric air to mingle with them in the pipe leading to the chimney.

6. To distribute liquids equally in stills or absorbing vessels, the following arrangement is proposed:—A number of pipes, set at a convenient distance apart, and having small holes drilled in them, are employed to conduct the liquid. A tumbler, divided by a central plate into two triangular or hopper-like compartments, is so suspended by pivots over a box and underneath the supply tap, that when filled it shall reverse its position, empty its contents, and bring the opposite end uppermost to be filled in its turn. The object of this arrangement is to convert the continuous flow into intermittent supplies, each sufficient to fill the box. Or instead of the preceding apparatus, a hollow central vertical spindle, having radial hollow arms perforated on the under side, may be employed. Rotary motion is communicated to the spindle, and the liquid flowing through it to the radial arms is equally delivered through the perforation to the still, &c.

7. In order to deprive coal gas of its naphthaline, the patentee causes it to pass through a solution of caustic potash, and lime, or caustic soda, and lime, which is contained in a vessel constructed and arranged similarly to a wet gas purifier.

Claims.—1. Mixing thick tar or pitch, deprived of its naphtha, with breeze, small coke, or coal, to be used in conjunction with ordinary coal in making gas.

2. Running thick tar or pitch into red-hot retorts, partly filled with coke or other suitable substance, so as to form heated surfaces over which the generated gas is to pass.

3. Passing the vapour of naphtha through red-hot retorts, partly filled with coke, so as to form an illuminating gas.

4. Mixing the waste gas from wood (obtained in the manufacture of pyroligneous acid) with the gas obtained from the rich hydrocarbons or from coal.

5. Distilling the volatile solutions of ammonia, whether pure or mixed with other gases, by running them through greatly divided media, contained in a suitable chamber or tower, while a current of steam or heated air is brought into direct contact with them by being caused to pass through the media in an opposite direction.

6. Concentrating saline solutions, by causing them to percolate through suitable media, over or through which heated air, or the gaseous products of combustion, are made to pass in an opposite direction.

7. Driving off the more aqueous vapours of sulphuric acid, by causing heated air, or the gaseous products of combustion, to pass through a tower or column containing suitable media, through which the sulphuric acid is made to percolate.

8. Effecting the absorption of gases by liquids for which they have an affinity, as before described.

9. Extracting or clearing the noxious or other vapours from ammoniacal saturators, gas purifiers, and other absorbing vessels, and the purifying materials employed in them, by passing a current of steam or atmospheric air, whether at ordinary or high temperatures, to pass through them to the furnace or chimney.

10. Preventing the gases drawn from such vessels or substances from forming explosive compounds, by mixing with them a sufficient quantity of steam, atmospheric air, carbonic acid, or other suitable gas, to render them inexplosive.

11. Distributing liquids equally into stills or other absorbing vessels, by means of a tumbler or revolving radial arms.

12. Freeing coal gas from its naphthaline, by passing it through solutions of caustic potash and lime, or caustic soda and lime.

ROBERT WILLIAM SIEVIER, Upper Holloway, Middlesex, gentleman. *For improvements in the means of warping and weaving plain and figured fabrics.* Patent dated October 19, 1849.

These improvements consist—

1. In a peculiar mode of weighting the bobbins, so as to regulate the pressure according to the strength of the material to be warped, and to obtain an even amount of pressure upon the bobbins, whether filled or empty, so that the tension and lengths of the yarns or threads may be nearly equal during the warping operation; and,

2. In a mode of forming artificial selvages

to "narrow wares," whereby two or more of them may be woven in one width, and afterwards divided.

1. Above the bobbin there is a bent lever or presser bar, supported by a pin at one end, and screwed at the other end, which carries a weight capable of being adjusted to the strength of the material. At the elbow of the presser bar there is a friction roller, which rests upon yarn wound round the bobbin. When the bobbin is filled, the weighted end is at right angles to the bobbin; but as the yarn is wound off, the angle becomes more acute, and the tension remains the same.

2. The patentee proposes next to weave several pieces of "narrow wares" in one width, with plain work between each, in which he interweaves during the same operation threads of gutta percha, or of other similar suitable material, supplied from separate bobbins. When the piece is completed, it is passed between a series of pairs of hollow rollers, set at distances apart corresponding with the breadth of each piece in the width, and keyed upon two hollow shafts, into which steam may be admitted to heat them. The heat and action of these rollers reduce the gutta percha to a semi-fluid state, and incorporate it with the fibres of the goods, so as to form, when cold, an artificial selvage, and prevent them unravelling when cut into their proper widths. The same object may be effected by weaving the wares in one width, and, after dividing it as may be necessary, coating the edges with a gutta percha solution, or by laying threads of gutta percha along the edges of the fabric, and incorporating them with the fibres by passing it under heated rollers as before.

Claims.—1. The mode of weighting the bobbins.

2. Weaving "narrow wares" in one width, and interweaving at regular and suitable distances threads, yarns, or strips of gutta percha, or other similar and suitable materials which are incorporated in the fabric by being subjected to heat and pressure, and when the width is divided forming an artificial selvage to each separate piece, and preventing the fibres from unravelling.

3. Forming this artificial selvage by coating the edges of the fabrics with gutta percha or other similar and suitable material dissolved in a suitable solvent. Or

4. By laying a thread, strip, or yarn, of gutta percha, &c., along the edges of the fabric, and subjecting it to heat and to pressure to incorporate it with the fibres of the fabric.

RICHARD ARCHIBALD BROOMAN, of the Patent Office, 116, Fleet-street. *For certain improvements in the manufacture of hinges and the machinery or apparatus employed therein.* (A communication from abroad.) November 2, 1848.

For specification and claim, see *ante* p. 386.

NOTES AND NOTICES.

The Royal Society.—The new President, Lord Rosse, gave his first *soirée* on Saturday last, at the suite of apartments at Somerset House occupied by the Royal and Antiquarian Societies. The exhibition of mechanical inventions was on this occasion scantier than usual. Next to the noble President's own monster telescope, the only one worth notice was a beautiful working model of Cochran's Ship-Timber Sawing Machine, corresponding in all particulars with the engravings which we recently gave of it. Prince Albert honoured it with a most minute examination, and was at the pains of testing its capabilities by assisting with his own hands to cut out a miniature futtock of extremely difficult curves. His Royal Highness complimented the inventor in very flattering terms on the originality and great practical usefulness of his invention.

Jurisprudence, as Affecting Arts and Manufactures.—The Society of Arts have appointed a Special Committee to investigate this subject, and to report what amendments, if any, in the existing laws are desirable.

Lord Lyndhurst and Lord Denman.—It is a rare instance for a lawyer thoroughly to master a case in machinery, and among others one is mentioned which particularly redounds to Lord Lyndhurst's honour. In the famous patent dispute about the lace machines of Mr. Heathcote, Lord Lyndhurst—then Mr. Copley—actually devoted ten days to observing and studying the machines themselves, and learning everything about them. Lord Denman—then Mr. Denman—was his junior; he knew nothing beyond the law, and took no interest in the machinery: and whilst Copley was posing all opposition with his mechanical knowledge, Denman was asleep hours at a time during the trial.—*Journal of Design.*

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 22ND OF MARCH, TO THE 21ST OF APRIL, 1849.

Charles Henri Paris, manufacturer, for improvements in preventing the oxidation of iron, March 26; six months.

William Edward Newton, 66, Chancery-lane, Middlesex, C.E., for improvements in machinery for hulling and polishing rice and other grain seeds. March 26; six months.

James Fletcher, of Salford, Lancaster, manager at the Works of Messrs. William Collier and Company, of Salford, machinist and tool makers, and Thomas Fuller, of Salford, machinist and tool maker, a partner in the said firm, for certain improvements in machinery, tools, or apparatus for turning, boxing, planing, and cutting metal and other materials. March 26; four months.

Walter Neilson, of Hyde-street, Glasgow, engineer, for a certain improvement, or certain improvements in locomotive engines. March 27; six months.

Jean Adolphe Carteron, of Paris, now of the Haymarket, Middlesex, chemist, for certain improvements in dyeing. March 27; six months.

David Henderson, of the London Works, Renfrew, Scotland, engineer, for improvements in the manufacture of metal castings. March 29; six months.

William Longmaid, of Beaumont-square, Middlesex, gent., for improvements in treating the oxide of iron, and in obtaining various products therefrom. April 4; six months.

Francis Hay Thomson, of Hope-street, Glasgow, D.M., for an improvement or improvements in smelting copper or other ores. April 11; six months.

Clemence Augustus Kurtz, of Wandsworth, Sur-

rey, gent., for certain improvements in looms for weaving. (Communication.) April 11; four months.

Barthelemy Thimounier ainé, of Amplepuis, Department de Rhone, France, engineer, for improvements in machinery for sewing, embroidery, and for making cords or plats. April 11; six months.

Alfred Vincent Newton, 66, Chancery-lane, Middlesex, for improvements in the manufacture of piled fabrics. (Communication.) April 13; six months.

Arthur Dunn, of Dalston, chemist, for improvements in ascertaining and indicating the temperature and pressure of fluids. April 13; six months.

Jeremiah Brown, of Kingswinford, Stafford, roll turner, for certain improvements in rolls and machinery used in the manufacture of iron; also in rolls and machinery for shaping or fashioning iron for various purposes. April 13; four months.

William M'Bride, jun., of Sligo, Ireland, but now of Havre, France, merchant, for improvements in the apparatus and process of converting salt water into fresh water, and in oxygenating water. (Communication.) April 16; six months.

John Ruthven, engineer, Edinburgh, Scotland, for improvements in preserving lives and property from water, and in producing pressure for various useful purposes. April 17; six months.

William Henry Balmain, and Edward Andrew Parnell, both of St. Helens, Lancaster, manufacturing chemists, for improvements in the manufacture of glass, and in the preparation of certain materials to be used therein, parts of which improvements are also applicable to the manufacture of alkalies. April 17; six months.

Stephen White, of Victoria-place, Bury, New-road, Manchester, Lancaster, gas engineer, for improvements in the manufacture of gases, and in the application thereof to the purposes of heating and consuming smoke, also improvements in furnaces for economising heat, and in apparatus for the consumption of gases. Six months.

Charles Alexander Broquette, of Rue Neuve St. Nicholas, St. Martin, France, chemist, for improvements in printing and dyeing fibrous and other materials. April 20; six months.

Søren Hjorth, of Jury-street, Aldgate, London, for certain improvements in the use of electro-magnetism, and its application as a motive power, and also other improvements in its application generally by engines, ships, and railways. April 20; six months.

James Hart, of Bermondsey-square, engineer, for improvements in machinery for manufacturing bricks and tiles, parts of which machinery are applicable to moulding other substances. April 20; six months.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Charles Alexander Broquette, of Rue Neuve, St. Nicholas, St. Martin, France, chemist, for improvements in printing and dyeing fibrous and other materials. April 21; six months.

William Kilner, of Sheffield, engraver, for improvements in manufacturing railway and other axles and wheels, and in machinery to be employed in such manufacture. April 24; six months.

Lewis Vernet, of Buenos Ayres, for a method of preserving from destruction by worms, insects, decay, and fire, certain vegetable and animal substances. April 24; six months.

Thomas Harcourt Thompson, of Blackheath-hill, civil engineer, for certain improvements in apparatus for preventing the rise of effluvium from drains, sewers, cesspools, and other places, and in apparatus and machinery for regulating the level of waters in rivers, reservoirs, and canals. April 26; 6 months.

George Simpson, of Newington-butts, chemist, and Thomas Forster, of Streatham, manufacturer, for improvements in manufacturing or treating solvents of India-rubber, and of other gums or substances. April 26; six months.

John Barsham, of Chelmsford, Essex, manufacturer, for improvements in separating the fibre from cocoa-nut husks. April 26; six months.

Charles Iles, of Bordesley Works, Birmingham, machinist, for improvements in manufacturing picture-frames, inkstands, and other articles in dies or moulds; also in producing ornamental surfaces. April 26; six months.

William Falconbridge, of Long-lane, Bermondsey, Surrey, for improvements in the manufacture of hose, pipes, driving-bands, and valves for atmospheric railways. April 26; six months.

Bartholomew Beniowski, of Bow-street, Covent Garden, major in the late Polish army, for improvements in the apparatus for and process of printing. April 26; six months.

Robert Oxland, of Plymouth, chemist, and John Oxland, of the same place, chemist, for improvements in the manufacture of sugar. April 26; six months.

William Henry Burke, of Tottenham, manufacturer, for improvements in the manufacture of air-proof and waterproof fabrics, and in the preparation of caoutchouc and gutta percha, either alone or in combination with other materials, the same being applicable to articles of wearing apparel, bands, straps, and other similar useful purposes. April 26; six months.

John Horsley, of Ryde, in the Isle of Wight, practical chemist, for certain improvements in preventing incrustation in steam and other boilers; also for purifying, filtering, and otherwise rendering water fit for drinkable purposes. April 26; six months.

Alphonse Garnier, late of Paris, but now of South-street, Finsbury, merchant, for certain improvements in extracting and preparing colouring matter from orchil. (Being a communication.) April 28; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subject of Design.
April 19	1853	Samuel Suter	Birmingham	Scratch brush.
,,	1854	Henry Woodfall	Foot's Cray, paper-maker	Watermark to be applied to writing paper. (To be called the diagonal lined paper.)
20	1855	John Classon	Blackhall-place, Dublin	Denoter of time.
21	1856	James Kean	Sunderland	Machine for making bricks and tiles.
23	1857	Henry Field	Glasgow	Gas-heater for baths.
,,	1858	Richard Hornsby	Lincoln, agricultural implement maker	Portable farm-engine boiler.
24	1859	Joseph W. Schlesinger,	Clement's-lane, London	Revolving blotter.
25	1860	Thomas Key	Charing-cross	Compensation valve-rod for cornet à pistons, trumpets, horns, &c.
,,	1861	John Scott	Tixall, Staffordshire	Remington and Scotts' bridge.
,,	1862	James Phillips and George Hunt	Birmingham	Shell back of wood for a button.

Advertisements.

Neuber's Improved Liquid Glue,

Impervious to DAMP or HEAT, perfectly free from smell, and ready for immediate use.

FOR WOOD, METAL, STONE, MARBLE, IVORY, SLATE, GLASS, CHINA and EARTHENWARE, Plaster Models, Paper and Pasteboard, and various other purposes, this cement will be found a most invaluable acquisition. Sold by all Chemists, Oil and Colourmen, Stationers, &c.; and also at the Patentees, Messrs. NEUBER and WATKINS, Varnish and Japan Manufacturers, 549, New Oxford-street, and 76, Long Acre; where samples may be obtained, or forwarded, free, on receipt of 12 postage stamps. Price, Pale, 12s., Dark 8s. per gallon; and in Bottles at 6d., 1s., and 1s. 6d.

All Letters, Orders, &c., to be directed to 549, New-Oxford-street.

EXTRACTS FROM THE LONDON PRESS.

" For repairing anything short of a 'kingdom out of joint,' or 'a broken constitution,' this Improved Liquid Glue seems quite up to the mark. We have tried it on a China dish, a wooden box, and a meerschaum pipe, with equally satisfactory results."—Vide *Builder*, Dec. 30, 1848.

" It will not mix with water, is consequently impervious to moisture, and remains quite unaffected in damp situations. It is incombustible, free from the slightest smell, dries quickly after a joint is made with it, and its adhesiveness and tenacity are, under most circumstances, superior to the common glue.—Vide *Mining Journal*, December 9, 1848.

PATENTEES, WHARF ROAD, CITY ROAD, LONDON.

GUTTA PERCHA COMPANY.

Wharf Road, City Road, London.

IT cannot now be doubted even by the most sceptical, but that GUTTA PERCHA must henceforward be regarded as one of the blessings of a gracious Providence, inasmuch as it affords a sure and certain protection from cold and damp feet, and thus tends to protect the body from disease and premature death. Gutta Percha Soles keep the feet WARM IN COLD, AND DRY IN WET WEATHER. They are much more durable than leather, and also cheaper. These soles may be steeped for MONTHS TOGETHER in cold water, and when taken out will be found as firm and dry as when first put in.

Gutta Percha Tubing,

Being so extraordinary a conductor of sound, is used as speaking tubes in mines, manufactories, hotels, warehouses, &c. This tubing may also be applied in Churches and Chapels, for the purpose of enabling deaf persons to listen to the sermon, &c. For conveying messages from one room to another, or from the mast-head to the deck of a vessel, it is invaluable. For greater distances the newly-invented Electric Telegraph Wire covered with Gutta Percha is strongly recommended.

Mill Bands.

The increasing demand for the Gutta Percha strapping for driving-bands, lathe-straps, &c., fully justifies the strong recommendations they have everywhere received.

Gutta Percha Pump Buckets, Clacks, &c.

Few applications of Gutta Percha appear likely to be of such extensive use to manufacturers, engineers, &c., as the substitution of it for leather in pump buckets, valves, &c. These buckets can be had of any size or thickness WITHOUT SEAM OR JOINT; and as *cold water will never soften them*, they seldom need any repair.

Gutta Percha Picture Frames.

The Gutta Percha Company having supplied HER MAJESTY THE QUEEN with several elaborate Gutta Percha Picture Frames for Buckingham Palace, which have been highly approved by the Royal Family, fully anticipate a great demand for frames from the nobility throughout the country. In order that the picture-frame makers may not be injured, the Company will supply the trade with the mouldings, corner and centre pieces, &c., and allow them to MAKE UP the frames. Pattern books for the trade are now ready.

Gutta Percha soles, solution, inkstands, card-trays, medallions, picture-frames, brackets, mouldings, window-blind cord, soap-dishes, tap-ferrules, cornices, vases, fire buckets, bowls, pen-trays, stethoscopes, thin lining, thread, flower-pots, ear-trumpets, &c., &c., manufactured at the Company's Works, Wharf-road, City-road, London; and sold by their Wholesale dealers in town or country.

Errata.—P. 341 col. 1, line 27, for "secundem," *read* "secundum."
P. 362, col. 2, line 20, for "apart," *read* "in fact."
P. 363, col. 2, line 19, for "which they may do," *read* "where they may do so."
P. 374, col. 2, last line but one, for "comment," *read* "communication."

CONTENTS OF THIS NUMBER.

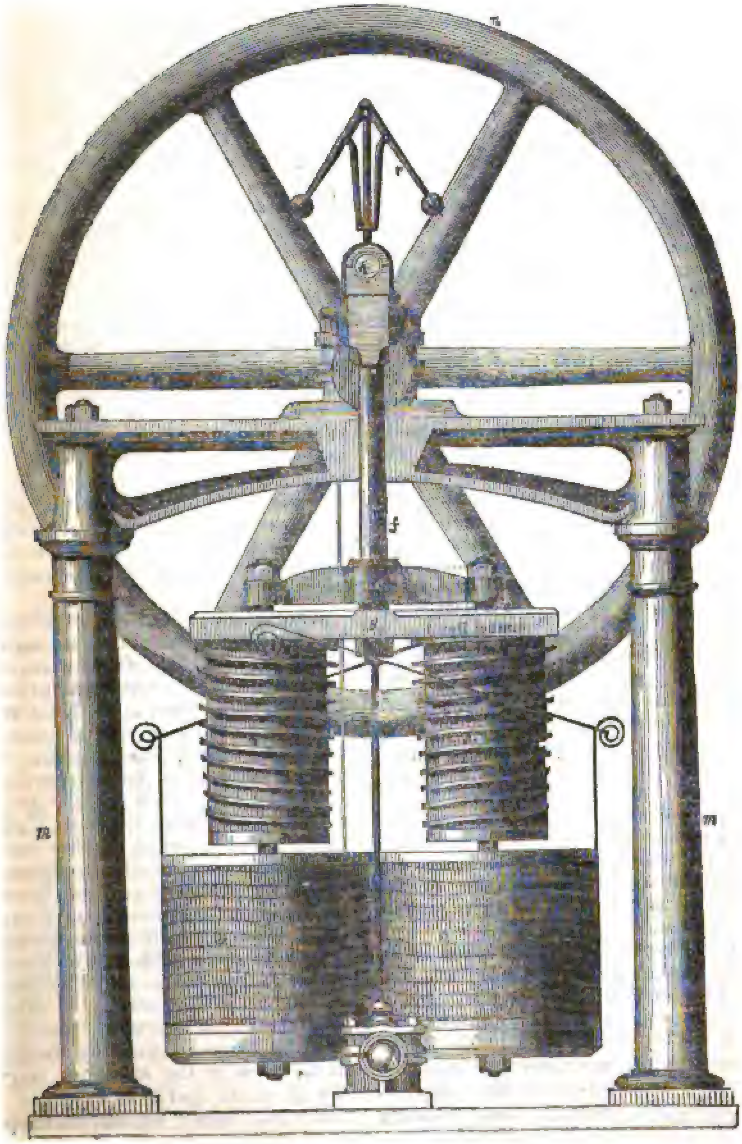
LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1343.] SATURDAY, MAY 5, 1849. [Price 3*d*, Stamped, 4*d*.
Edited by J. C. Robertson, 166, Fleet-street.

HJORTH'S ELECTRO-MAGNETIC MOTIVE ENGINE.

Fig. 1.



MR. HJORTH'S ELECTRO-MAGNETIC MOTIVE ENGINE.

[Patent dated October 26; 1848; Specification enrolled April 26, 1849.]

The Specification.

My invention relates to certain improvements in the use of electro-magnetism, and its application as a motive power for general purposes, and also to certain improvements in the application of electro-magnetism to engines, ships and railways.

In this specification the word "Magnet," unless otherwise defined, is used generally to signify either a permanent magnet or metal, or other substance made magnetic by a current of electricity.

My improvements in the use of electro-magnetism, and its application as a motive power for general purposes, relate to a mode of obtaining such power by the reciprocal or rotary motion of magnets, or electro magnets.

My invention consists in obtaining such power by means of magnets, or electro magnets, both fixed and moveable, formed and arranged in such a way, that during the motion of the moveable magnet, or magnets, separate points or parts of the surface of the moveable magnet, or magnets, or metallic armatures or the poles of the several moveable magnets, shall be brought separately, and successively to act upon, or be acted upon by the separate points, or parts of the surface or poles of the fixed magnet, or magnets, or metallic armatures, and so that the attraction or repulsion of one point, or part of the surface or pole, shall be followed up by the attraction or repulsion of another point, or part of the surface or pole, so that a rotary or reciprocal action may be obtained, and sustained over a greater length of stroke or circuit, than by the simple action of magnets, or electro magnets, arranged in the ordinary manner.

I will now proceed to illustrate my invention by describing some of the forms of apparatus by which it may be carried out.

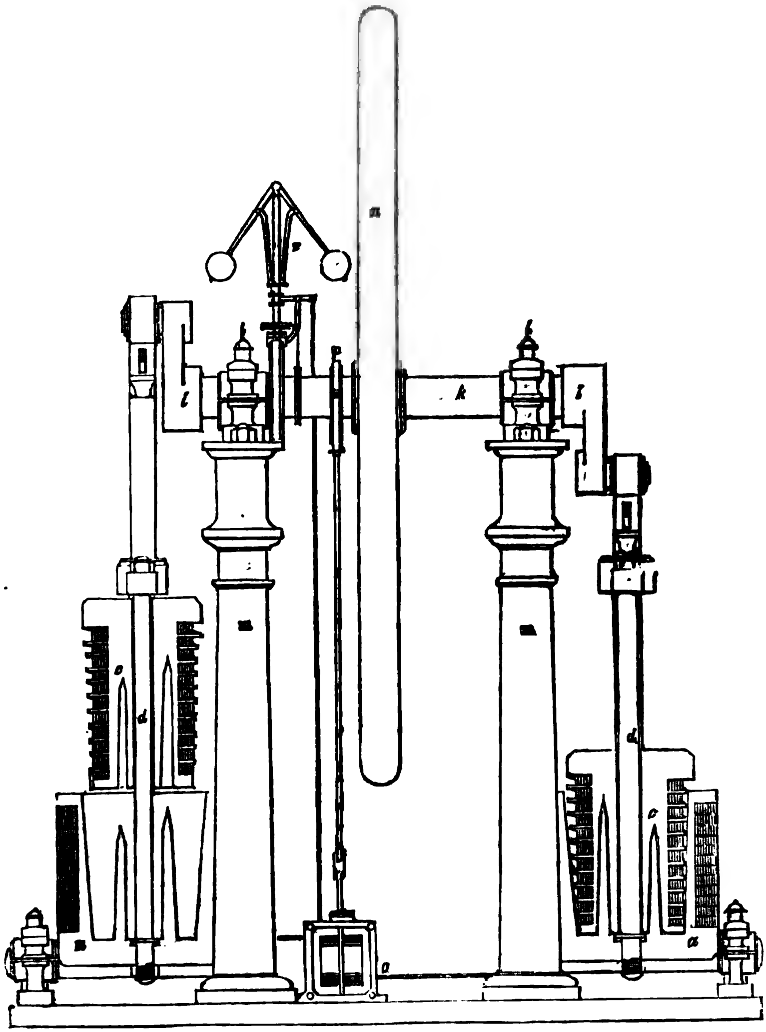
Fig. 1 represents the elevation of an engine made on this principle; and fig. 1*, a section of the same engine. *a a*, is a horseshoe-formed hollow magnet, conical on the inside, coiled with copper or other wires, and suspended in such a way that it oscillates on the centre, *b*, with suitable bearings and plummer blocks, as shown in the figure. In the interior of this magnet is fixed a number of conical rods of different lengths; *c c*, is another horseshoe-formed magnet, conical on the outside, with apertures corresponding to the conical rods in the magnet, *a a*, and likewise coiled with wire. This magnet moves on the guide-rods, *d d*, which are connected together at the top by means of the cross-head, *e*, and fastened at the bottom of the magnet, *a a*. The guide-rods may also be fixed to the magnet, *c c*, and guided by rollers, as represented in fig. 8; *f* is a connecting rod fixed to the magnet, *c c*, in the centre, *g*, and at the crank-pin, *h*, by means of a strap, or any of the usual methods. *i i* are cranks fixed on the shaft, *k*, which works in bearings, *l*, supported on the frame, *m*; *n* is a fly-wheel fixed on the shaft, *k*. *o* is the commutator to change the electric current as required, which is similar in its mode of working to the slide-valve of a steam-engine, and moved in a similar way by an eccentric, *p*, and eccentric-rod. The action of the engine may be reversed by the use of a supplemental eccentric. The governor, *r*, serves to regulate the proper supply of the electric current to the commutator, *o*, as afterwards described.

The current, after being regulated by the governor, is introduced through the commutator into the helix of wires coiled round the magnet, *aa*, and thence through the conducting wires to the helix or coil of wires surrounding the magnets, *cc*, and thence through the conducting wires to the battery, or by the reverse course, as may be found convenient. As soon as the electric fluid from the batteries passes round the magnets, they exercise their power by a mutual attraction, not only in the ordinary way, but, in consequence of the magnets being so shaped that the inside part of the outer magnet, as well as the outside part of the inner magnet, forms angles with the direction of motion of the moving or working magnet; and at the same time rods of different lengths presenting themselves at the poles of the respective magnets, the attractive power is sustained over the whole stroke by successive points

and successive parts of the surfaces being brought to act upon one another during the whole stroke. When the stroke in this manner has been made by one set of magnets, the current is changed, and the other set of magnets are made effective by the current passing round them in the same manner as before described. In order to prevent the current from being broken, and also to check the momentum of the magnets, the slide in the commutator, *o*, is made so long that it does not leave the conducting surface which communicates with one set of magnets until it has reached the other communicating with the other set of magnets.

By the arrangements above described,

Fig. 1ᵃ.



a reciprocating motion is obtained similar to that of the common oscillating steam engines, and it will be obvious that a motion may be obtained similar to that

obtained by any of the various forms of steam engines by suitable adaptations of beams, rods, cranks, &c. Thus it may be carried out as a single or a double acting engine, as an ordinary beam engine, or as a direct action engine, accord-

Fig. 2.

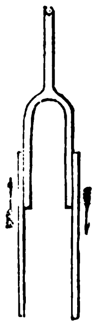


Fig. 2ª.

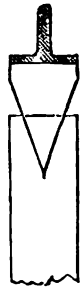


Fig. 3.

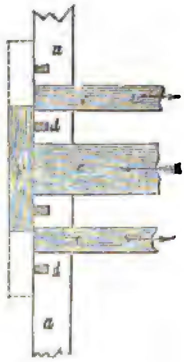


Fig. 5.

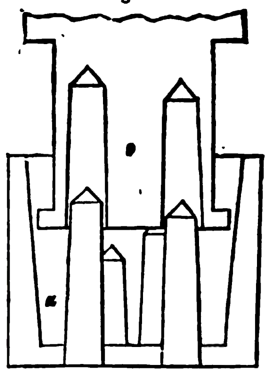


Fig. 7.

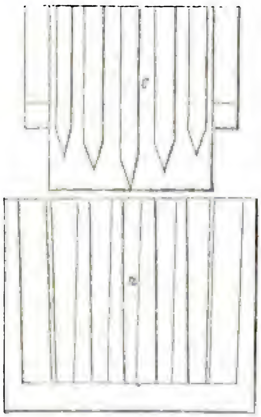


Fig. 4.

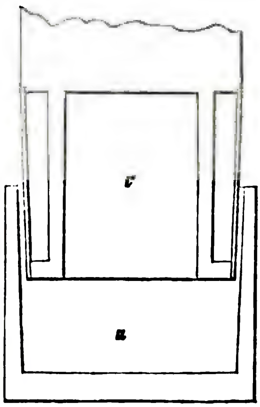


Fig. 6.

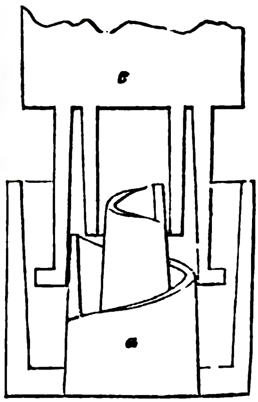


Fig. 5ª.

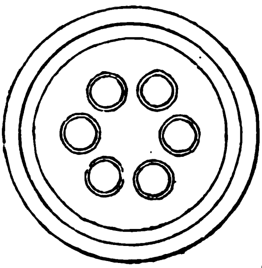


Fig. 7ª.

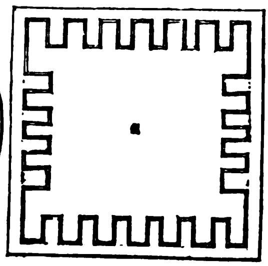
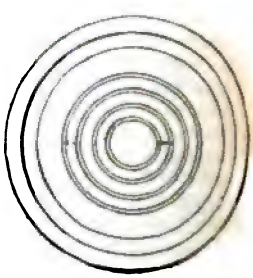


Fig. 6ª.



ing as it may be required for stationary, locomotive, or marine purposes; and in all cases its form may be varied according to the circumstances of the case.

Figs. 2 and 2ª represent, on a larger scale, my apparatus for regulating the current. Its action may be readily understood from the figures. I choose, as the most convenient form, a forked piece of metal, with two wedge-shaped prongs sliding along two parallel surfaces. The current from the battery passes, as indicated by the small arrows in the figure, from one of the parallel surfaces through the wedge-shaped fork to the opposite surface, and thence to the commutator; and the current will pass with greater or less intensity according to the amount of the communicating surface given by the larger or smaller part of the wedge. The particular form is immaterial, so that taper pieces of metal are used, which, by the ordinary action of the governor, may give greater or less communicating surface.

My commutator is shown, in fig. 3, on

Fig. 3ª.

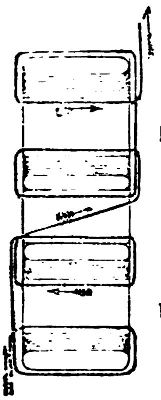
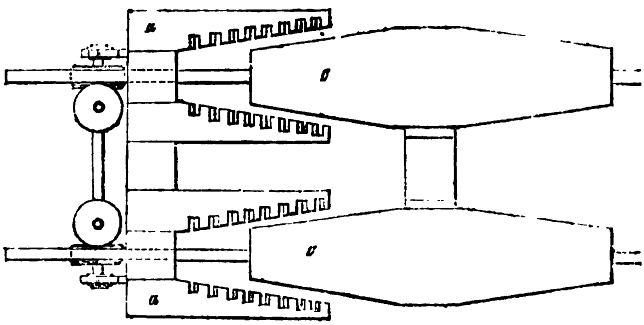


Fig. 3.



a larger scale. This apparatus consists of three metal surfaces, *c*, *c*, *c*, placed in a non-conducting medium, such as wood, *a a*. The metal surface or slide, *b*, is shaped and moved in such a way as to conduct the electric fluid according to the motion of the engine alternately from the centre surface, which is connected with the battery to either one of the other and outer surfaces, which are connected respectively with the coils of the two sets of magnets. I make the slide, *b*, sufficiently long to be always in contact with one or other of the surfaces connected with the magnet coils, and by the adjustment of this length and of the eccentric, any required "lead," as it is termed in steam engines, may be obtained; *d d* is black-lead, which may be let into the insulating medium to facilitate the conduction, and at the same time to act as an anti-friction.

The whole apparatus or commutator may be inclosed in an air-tight box, with a glass lid or cover, the slide-rod working through a stuffing-box. Where large batteries are required for producing sufficient quantity of electricity to work powerful engines, a compound commutator, or several commutators, may be employed, each being connected with a certain number of cells, and a certain number of coils. By this means the destruction of the conducting points of the commutator will be avoided, the governor may act so as entirely to detach one or more of the commutators, and so throw off the cells of the battery communicating with such commutator.

Figs. 4, 5, 6, 7, and 8, represent some of the main variations in the form and shape of the magnets, *a a* and *c c*, which may be adopted for the purpose of carrying out my improvements in the use of electro-magnetism. In fig. 4, the coiling of the magnet, *c*, is surrounded with a sheet iron casing of a conical form, corresponding with the interior of the magnet, *a a*, in order to obtain a greater attractive surface, and to make the poles

of this magnet more effective. Fig. 5 is an enlarged view of the magnets, *a a* and *c c*, in fig. 1. In fig. 6 a long stroke and great attractive surface are obtained by placing a spiral-shaped surface in the interior of the magnet, *a a*, and corresponding grooves or apertures in the magnet, *c c*. By this arrangement the magnet, *c*, will act or exercise an attractive power on the successive points of the spiral-shaped surface, before mentioned, in the same manner as the magnet, *c c*, acts on the rods of different lengths placed in the magnet, *a a*, in fig. 1. Fig. 7 represents a magnet, *c*, consisting of taper ribs of wrought iron of different lengths, arranged round a coiled central magnet with intervals between them, so that corresponding ribs placed round and inside of the hollow coiled magnet, *a*, may pass between the ribs of the magnet, *c*, after being attracted by the same. Figs. 5*, 6*, and 7*, represent horizontal sections of the magnets, *a*, in the corresponding figs. 5, 6, and 7. Fig. 8 represents a horseshoe magnet, *a*, each leg of which is divided into two pieces inclined on the inside, and with grooves inside to receive the wires, which are coiled as shown in fig. 8*, the current passing in the direction indicated by the arrows. The magnet, *c c*, is in this case not coiled with wires, being a permanent magnet.

(*To be concluded in our next.*)

NOTE ON A FORMER ARTICLE ON CONGENERIC EQUATIONS.

BY PROFESSOR YOUNG, BELFAST.

In a short article on Congeneric Surd Equations, at p. 463 of vol. xlix., I incidentally noticed that an equation of the nth degree might be decomposed into n equations of the first degree in more ways than one. I have since observed that such decomposition may be effected in an unlimited number of ways; and which will appear obvious from considering the identity

$$X=\left\{F+\sqrt{(F^2-X)}\right\}\times\left\{F-\sqrt{(F^2-X)}\right\}\ \ldots.(A),$$

in which F and X may be any expressions whatever, so that, by giving different arbitrary values to F, any form, X, may be decomposed into conjugate, or congeneric factors, in as many ways as we please. As an instance of the conjugate factors of x^2+a^2, which are usually stated to be

$$x+a\sqrt{-1},\ x-a\sqrt{-1},$$

may, with equal truth, be affirmed to be

$$x+p+\sqrt{2px+p^2-a^2},\ x+p-\sqrt{2px+p^2-a^2},$$

in which p is anything; and which furnishes the former pair when $p=0$; and it is plain that this is only one of an endless variety of generic forms, all equally admissible.

It is obvious that an algebraical form may thus be decomposed into conjugate factors, such that either the first term of each pair, or the second term of each pair, may be a prescribed expression; and I think we thus have suggested to us a method of establishing the formula for the solution of quadratic equations, which might be preferred by a learner even to the processes in common use; thus, let the equation to be solved be

$$X=x^2+px+q=0,$$

then we may so choose F in (A) that the quantity under the radical may be free from x, and which merely requires that we make $F=x+\frac{1}{2}p$, whence

$$x^2+px+q=$$
$$\left\{x+\tfrac{1}{2}p+\sqrt{\tfrac{1}{4}p^2-q}\right\}\times$$
$$\left\{x+\tfrac{1}{2}p-\sqrt{\tfrac{1}{4}p^2-q}\right\}=0,$$

and, since a product is 0, when either of its factors is, we are at liberty to equate either of the factors here exhibited to 0; and from which we therefore get

$$x=-\tfrac{1}{2}p\pm\sqrt{\tfrac{1}{4}p^2-q},$$

the ordinary formula of solution.

In a paper which will appear in the *Philosophical Magazine*, simultaneously with the present Note in this Journal, will be found some other deductions from the identical equation (A).

Belfast, March 20, 1849.

Newton, by supposing that the earth was originally a homogeneous mass revolving on an axis in $23^h\ 56'\ 4''$ solar time, came to the conclusion that it assumes the figure of an oblate spheroid, of which the polar is to the equatorial diameter as 229 : 230.*

It was subsequently demonstrated by Clairault,† that if a fluid mass revolving on an axis be not homogeneous, but be composed of strata, which increase in density towards the centre, its figure of equilibrium will still be an elliptic spheroid, but that its oblateness will be less than if it were homogeneous.

Clairault's investigations, moreover, determine the form of equilibrium which a fluid assumes under the following supposition; viz., 1st., That the fluid is homogeneous with a spheroidal nucleus of different density.

2ndly, That the whole mass is fluid and heterogeneous.

The form which makes equilibrium possible in all the variety of cases which these suppositions include is approximately an elliptic spheroid. The ellipticity or oblateness of the spheroid is different according to the law of density, &c., but in all cases the following theorems are true:—

1st., The increase of *degrees* and of *gravity* in going from the equator to the poles is as the square of the sine of the latitude.

2nd, The sum of the ellipticity and of the ratio of the whole increase of gravity to the equatorial gravity is the fraction $\frac{5}{2}$ multiplied into the ratio of the centrifugal force at the equator to the force of gravity.‡

These celebrated theorems admit of direct proof by actual admeasurement. Accordingly, geodetic measures and pendulum experiments have been undertaken and completed in various parts of the globe by the ablest astronomers furnished with the best instruments; a condensed epitome of their labours is given in Airy's Treatise already referred to.

The lengths of meridian arcs corresponding to a given difference of latitude have been determined in various places by geodetic measurements, and the law of the variation of the force of gravity at different points on the earth's surface has been ascertained by the vibrations of pendulums. The results of these admeasurements and experiments have not only been applied to test Clairault's theorems, but also to determine the earth's ellipticity: other deductions respecting the figure of the earth have been derived from assumptions more or less accurate according to the hypothesis adopted with regard to the earth's density, &c. But geodetic measures, and the vibrations of pendulums in almost every latitude, have clearly established the fact, that the force of gravity varies in accordance with Clairault's Theorem.

Since then, the intensity of gravity in going from the equator to the pole, varies as the square of the sine of the latitude, it follows that the *weight* of a body in being carried from the equator to the poles varies at the same rate. Hence, another criterion by which the figure of the earth may be tested is furnished: for, if a body vary in weight at all the intermediate latitudes between the equator and the poles, according to Clairault's law, such variation would undoubtedly go far to establish the results derived from theory, and to confirm the inferences from experiments.

But how can the weight of a body at different stations be ascertained so as to determine such a fact, if it exist? Sir John Herschel* has answered this question so clearly and satisfactorily, that I think I cannot do better than transcribe his observations on the point:—

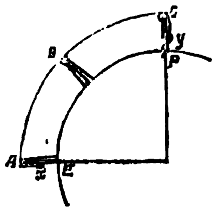
"When we weigh a body by a balance or steelyard, we do but counteract its weight by the equal weight of any body under the same circumstances: but, if both the body weighed and its counterpart be removed to another station, their gravity, if changed at all, will be changed equally, so that they will still continue to counterbalance each other. A difference in the intensity of gravity could therefore never be detected by these means; nor is it in this sense that a body weighing 194 pounds at the equator, will weigh 195 pounds at the poles. If counterbalanced in a scale or steelyard at the former station, an additional pound

* Princip. lib. 3, Prop. 19.
† Fig. de la Terre.
‡ Airy, Fig. of the Earth, Metrop., page 170.

* Astronomy, page 123.

placed in one or the other at the latter would inevitably sink the beam.

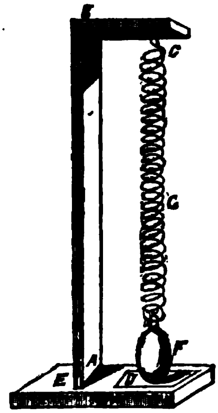
"The meaning of the proposition may be thus explained:—Conceive a weight sus-



pended at the equator by a string without weight passing over a pulley, A, and conducted (supposing such a thing possible) over other pulleys, such as B, round the earth's convexity, till the other end hung down at the pole, and there sustained the weight, *y*. If, then, the weights, *x* and *y* were such as, at any one station, equatorial or polar, would exactly counterpoise each other on a balance, or when suspended side by side over a single pulley, they would not counterbalance each other in this supposed situation; but the polar weight, *y*, would preponderate; and to restore the equipoise, the weight, *x*, must be increased by $\frac{1}{194}$th part of its quantity."

The following ingenious mode of ascertaining the variation in weight is extracted from the same work:—

"The means by which this variation of gravity may be shown to exist, and its amount measured, are twofold (like all estimations of mechanical power, statical and dynamical.) The former consists in putting the gravity of a weight in equilibrium, not with that of another weight, but with a natural power of a different kind not liable to be affected by local situation. Such a power is the elastic force of a spring. Let ABC be a strong support of brass standing on the foot, AED, cast in one piece with it, into which is let a smooth plate of agate, D, which can be adjusted to perfect horizontality by a level. At C, let a spiral spring, G, be attached, which carries at its lower end a weight, F, polished, and convex below. The length and strength of the spring must be so adjusted, that the weight, F, shall be sustained by it, just to swing clear of contact with the agate plate in the highest latitude at which it is intended to use the instrument. Then, if small weights be added cautiously, it may be made to descend till it *just grazes* the agate, a contact which can be made with the utmost imaginable



delicacy. Let these weights be noted—the spring, G, carefully lifted off its hook and secured for travelling from rust, strain, or disturbance—and the whole apparatus conveyed to a station in a lower latitude. It will then be found, on remounting it, that, although loaded with the same additional weights as before, the weight, F, will no longer have power enough to stretch the string to the extent required for producing a similar contact. More weights will require to be added; and the additional quantity necessary will, it is evident, measure the difference of gravity between the two stations, as exerted on the whole quantity of pendent matter, *i. e.*, the sum of the weight, F, and *half* that of the spiral spring itself. Granting that a spiral spring can be constructed of such strength and dimensions that a weight of 10,000 grains, including its own, shall produce an elongation of 10 inches without permanently straining it, one additional grain will produce a further extension of $\frac{1}{1000}$th of an inch, a quantity which cannot possibly be mistaken in such a contact as that in question. Thus, we should be provided with the means of measuring the power of gravity at any station to within $\frac{1}{10000}$th of the whole quantity."

(The other mode of measuring dynamically the variation of gravity, referred to, is by the oscillation of pendulums.)

Not differing widely, perhaps, in principle from the foregoing contrivance are the weighing machines in common use, constructed by Salter and others. The body to be weighed is attached to the end of a spiral spring connected with an

index, which points out the weight on a dial plate. Machines of this description are said to be capable of weighing many pounds, and of indicating the true weight to a considerable degree of exactness.

An instrument of the kind is described in Young's Lectures.* Although a machine of this sort could not, perhaps, be constructed to act with so great nicety as that devised by Sir J. Herschel, still it is likely that one might easily be made to show roughly, whether the weight of a body does vary in being carried from one latitude to another. I am persuaded that such a machine constructed with only moderate accuracy would sufficiently indicate such variation in weight as to confirm the deduction of theory: at all events, the experiment could easily be made without much trouble or expense, and it is by way of inducing parties, having the opportunity of carrying the suggestion into operation, to make the trial, that I have drawn up this paper. A ship that leaves the port of London for a place in a distant latitude, either north or south, at once affords an arena for testing the project. The inquiry is so interesting to men of science, that one might hope a trial will be made without delay, either by the commanders of Government vessels or by others. Whether the experiment were made by the instrument described by Sir John Herschel, or by the more common and less accurate one to which I have referred, I think it might be serviceable to have the means at hand in any latitude, of readily ascertaining the variation in weight which theory points out. I have endeavoured to furnish such aid, by constructing the following Table, which I will now explain.

Let m be the ratio of the centrifugal force to gravity at the equator $=\frac{1}{289}$†

ϵ, the earth's ellipticity.

G, the gravitation of the equator.

g, the gravitation at a place, the latitude of which is λ; then supposing the earth to have been a homogeneous fluid, according to Newton's hypothesis, we have

$$g=G(1+\epsilon\sin^2\lambda),$$

but, supposing the matter of the earth heterogeneous and increasing in density from the surface to the centre, we have by Clairault's Theo.,

$$\left.\begin{aligned} g&=G\left(1+\frac{5m}{2}-\epsilon\sin^2\lambda\right)\\ &=G(1+n\sin^2\lambda)\end{aligned}\right\}\ \text{Putting } \frac{5m}{2}-\epsilon=n.$$

Again, let g' be the gravitation at a place of which the latitude is λ'; then

$$g'=G(1+\epsilon\sin^2\lambda')$$

in the one case, and

$$=G(1+n\sin^2\lambda')$$

in the other.

$$\text{Hence, } \frac{g'}{g}=\left\{\begin{array}{c}\dfrac{1+\epsilon\sin^2\lambda'}{1+\epsilon\sin^2\lambda}\\ \text{or } \dfrac{1+n\sin^2\lambda'}{1+n\sin^2\lambda}\end{array}\right\}\text{according to the hypothesis adopted.}$$

It follows from what has just been done that if W denote the weight of a body at a place whose latitude is λ, and W′ the weight of the same body at the place of which the latitude is λ',

$$\text{then } \frac{W'}{W}=\left\{\begin{array}{c}\dfrac{1+\epsilon\sin^2\lambda'}{1+\epsilon\sin^2\lambda}\\ \text{or } \dfrac{1+n\sin^2\lambda'}{1+n\sin^2\lambda}\end{array}\right\}\text{as the case may be;}$$

$$\text{and } \therefore W'=\frac{1+\epsilon\sin^2\lambda'}{1+\epsilon\sin^2\lambda}\times W,$$

$$\text{or } =\frac{1+n\sin^2\lambda'}{1+n\sin^2\lambda}\times W.$$

Now if a known latitude be taken for λ, and each degree of latitude from the equator to the poles be taken for λ', the above expressions

* See Kelland's ed., page 98.

† See Airy's Tracts, *ut supra*: or O'Brien's Tracts, p. 48.

$$\frac{1+\varepsilon \sin^2 \lambda'}{1+\varepsilon \sin^2 \lambda}, \text{ or } \frac{1+n \sin^2 \lambda'}{1+n \sin^2 \lambda}$$

can be converted into a number, which being multiplied by W, the weight of the body at the place whose latitude is λ, will give the weight of the same body at any other place whose latitude is λ'.

The multipliers deduced from the above expressions will vary according to the earth's oblateness, the measure of which has been obtained by many writers from various principles. The following table exhibits some of these results:

Authors.	Ellipticities.	Principles.
Newton ..	$\frac{1}{230}$	Theory of gravity.
	$\frac{1}{579}$	
Clairault ..	$\frac{1}{1165}$	Rotary motion.
	$\frac{1}{323}$	Vibration of pendulums.
Maupertuis	$\frac{1}{314}$	Measuration of arcs.
	$\frac{1}{213}$	
Horsley ..	$\frac{1}{206}$	The mean of six measurements.
Boscovich..	$\frac{1}{248}$	Measurement of arcs.
Trieswicker	$\frac{1}{329}$	Occultation of stars.
Laplace ..	$\frac{1}{334}$	Precession and nutation.
	$\frac{1}{305}$	Theory of the moon.

Lalande makes it $\frac{1}{337}$; Sajour, $\frac{1}{307}$; Carouge, $\frac{1}{300}$; Playfair, $\frac{1}{304}$; Hutton, thinks it about $\frac{1}{320}$.*

Airy says that although Newton's mode of deducing the ellipticity is defective, it is not erroneous. Mr. Dalby† has inferred that the degrees of the meridian measured in middle latitudes correspond to an ellipsoid, the axes of which are in the ratio assigned by Newton; admitting that the earth was originally a homogeneous fluid, Newton's ellipticity is nearly correct. Hence, Mr. Dalby's inference seems to indicate that the middle latitudes correspond to such an hypothesis, and that they are not affected by the matter which has been drawn from the poles and accumulated at the equator by the earth's revolution. Be this, however, as it may, the first column of multipliers in the Table has been calculated on the supposition that $\varepsilon = \frac{1}{230}$; that is, λ has been taken for 51°, 32′, the latitude of London which makes the expression

$$\frac{230 + \sin^2 \lambda'}{230 + \sin^2 \lambda} = \frac{230 + \sin^2 \lambda'}{23061304};$$

the taking λ' from 1° to 90° has furnished the first column of multipliers in the Table.

Laplace, *Mec. Cel.*, liv. 3, v. 842, makes the earth's oblateness $\frac{1}{335 \cdot 78}$ which he says agrees in a remarkable manner with the ellipticity deduced from the measures in France and at the equator; his celebrated commentator, Dr. Bowditch, however has shown that Laplace has made a mistake in this matter, which being corrected, the ellipticity

* Delambre Ast.: tom. 3me. makes it $\frac{1}{309}$. Pontecoulant, tom. 2me, p. 475, makes $\frac{1}{320}$ the limit of all the values.

† Phil. Trans., for 1791.

becomes $\frac{1}{312}$ (Translation *Mec. Cel.*, vol. ii., p. 485). Dr. Bowditch comes to the conclusion that the earth's oblateness does not differ much from $\frac{1}{300}$, a value which he says he has always used in his calculations; this value agrees nearly with $\frac{1}{298}$, the ellipticity adopted by Sir John Herschel.* English writers on the figure of the earth, with whose works I am acquainted,† agree in assigning $\frac{1}{303}$ as the ellipticity of the earth obtained from geoditic measures.

From an irregularity which depends upon the longitude of the moon's node, Laplace made the earth's ellipticity $\frac{1}{303.5}$, from the irregularity depending upon the moon's motion in longitude, he made it $\frac{1}{303.6}$. Playfair‡ (as above) makes it $\frac{1}{334}$. Sejour $\frac{1}{307}$. All these values differ but little from each other. I therefore assume that ϵ may fairly be taken $= \frac{1}{300}$; hence, in Clairault's theorem,

$$\frac{5\,m}{2} - \epsilon = n\,;$$

we find $n = \frac{1}{186}$, and the second column of multipliers in the Table has been deduced from the expression

$$\frac{186 + \sin^2 \lambda'}{18661304},$$

in the manner already explained.

By grouping a considerable number of the results derived from the best pendulum experiments,§ and taking the mean of the groups, we obtain $\frac{1}{280}$ for the earth's ellipticity. This value of ϵ, by Clairault's theorem, gives $n = \frac{1}{194}$.

The third column of multipliers in the Table has been calculated from the expression

$$\frac{194 + \sin^2 \lambda'}{19461304}.$$

If the trial above recommended be made, and the weight of a body be taken at London, the table will readily assist to indicate the *theoretical* variation in weight in any latitude. If the weight at London be multiplied by the proper multiplier in the first column, the result will show the variation on the hypothesis that the earth is homogeneous. If the known weight be multiplied by the multiplier in the second column, the product will indicate the variation corresponding to the oblateness derived from geodetic measures, and nearly agreeing with that obtained from various other sources.

If the weight of the body at London be multiplied by the proper number in the third column, the result will show the variation which corresponds to the ellipticity derived from a great number of pendulum experiments.

It would be desirable to use *each* multiplier, and to tabulate the results, with the weights shown by the instrument. A table so formed would at sight indicate the experimental variation, and also show how nearly it agrees with, or how much it differs from, the theoretical variation obtained by the multipliers.

My object being merely to have some experiments tried in the rough, nothing has been said respecting the corrections for elevations or levels; nor yet with regard to the effect which different temperatures may have on the spring of the instrument employed;* these points may be deferred for the present. In using the Table, the number answering to the nearest degree will perhaps point out the variation sufficiently near for practical purposes.

It has been remarked above, that if the weight of a body at the place of which the latitude is λ, be multiplied by either of the *decimal* multipliers opposite to the degree corresponding to the latitude λ' in the table, the product will give the weight of the same body at the place λ'; it may not be inexpedient to add two or three examples. Suppose, as Sir John Herschel has done, that the body at London (the latitude λ) weighs 10·000 grains:

$$\text{At the } \textit{equator} \text{ it weighs} \left\{ \begin{matrix} \cdot 9973416 \\ \cdot 9967149 \\ \cdot 9968499 \end{matrix} \right\} \times 10{\cdot}000 = \left\{ \begin{matrix} 9973 \\ 9967 \\ 9968 \end{matrix} \right\} \text{Grains,}$$

(omitting fractions), according as the first, second, or third column of multipliers is used; so that it would require 27 grains in the first instance, 33 in the

* Astronomy.

† Airy's Tracts, p. 189. Pratt's *Mech. Phil.* p. 613. O'Brien's Tracts, p. 47.

‡ Works, vol. iii., p. 287.

§ Airy's Treatise, p. 230.

* Dr. Young (Lectures, Kelland's edition, p. 96,) says, "The strength of all springs is somewhat diminished by *heat*; and for each degree of Fahrenheit that the temperature is raised, we must deduct about one part in 5000 for the apparent weight indicated by the springs in the steelyard."

second, and 32 in the third, *to be added* in order to produce the contact in Sir John Herschel's instrument; or that the index may point to the same figure as it did at London in the other case.

Take Madras, lat. 13° 4′. The multiplier in the third column is ·9971103, which multiplied by 10·000, gives 9971, so that 29 grains must be *added* to restore the equilibrium.

At Spitzbergen, lat. 80°, the corresponding multiplier is 1·0018333, which multiplied by 10·000 gives 10·018, so that 18 grains must be *deducted* from the weight at London to produce the equilibrium.

The variation in weight becomes the more remarkable when larger quantities are taken; for instance, take a ship's cargo that weighs 1000 tons at London, using the multiplier in the first column in the Table, it will be found that it weighs 2 tons, 13 cwts., 0 qrs., 19 lbs. less at the equator; employing the third tabular multiplier the loss is 3 tons, 3 cwts., 0 qrs., 1 lb.

Similarly, at Jamaica, lat. 18°, the *loss* is 2 tons, 4 cwts., 3 qrs., 16 lbs., or 2 tons, 13 cwts., 0 qrs., 21 lbs., the same multipliers being used.

At Spitzbergen, lat. 80°, the *gain* is 1 ton, 10 cwts., 3 qrs., 21 lbs., or 1 ton, 17 cwts., 1 qr., employing the same multipliers.

Besides the immediate object for which the multipliers in the Table have been formed, some of them possibly may be serviceable in other matters. Thus, if the length of the second's pendulum at London be multiplied by the multiplier in the third column corresponding to any latitude the product will give the theoretical or calculated length of the second's pendulum for that latitude.

The length of the second's pendulum at London being taken = 39·13948′, and multiplied by ·9968499, the third tabular multiplier for the equator gives 39·0161867 for the length of the second's pendulum at the equator.

In Airy's Table,* Pulo Gaun. Lout. 0° 2′ N; or Rawak 0° 2′ S; the calculated length of the second's pendulum is 39·01677. The observed length at the latter place is 39·01433; the observed length at the former 39·02126: why the observed length of these pendulums at the same distance from the equator should differ so much is an interesting question not easily answered.

At Spitzbergen, lat. 79° 50′, the observed length is 39·21469: the calculated length 39·21081: if 39·13948 × 1·0018333 (the multiplier corresponding to 80°) gives 39·2112343, the length of the second's pendulum at the nearest degree.

39·13948 × ·9971103 (the multiplier for 13°) = 32·0263669 the length of the second's pendulum in that latitude.

In Airy's Table the calculated length for Madras 13° 4′ is 39·02700, the observed length 39·02630. The calculated length at Bahai 12° 59′, by the same Table is 39·02688; the observed length 39·02433.

Once more, 39·1394 × ·9973406 (the tabular multiplier of 18°) gives 39·0351229 for the length of the second's pendulum in the latitude: by the Table already named, the calculated length at Jamaica, lat. 17° 56′ is 39·03576; the observed length 39·03503. The minute discrepancies between some of these results are explained by the small differences in the latitude.

Barlow* says the weight of a body at the equator is to the weight of the same body at the pole as 1 : 1·100569: this assumes that $n = \frac{1}{178}$, and $\varepsilon = \frac{1}{289}$. Whatever may be said respecting the probability of the correctness of this assumption, or of any of the others which have been named, I am not aware that any attempt has been made to determine whether they are correct or not by actual experiment.

With regard to the modes of testing which have been discussed, Sir John Herschel says, speaking of the contrivance already cited, "whether the process, above described could ever be so far perfected and refined as to become a substitute for the use of the pendulum, must depend on the degree of permanence and uniformity of action of springs on the constancy, or variability of the effect of temperature on their elastic force: on the possibility of transporting them absolutely unaltered from place to place, &c. The great advantages, however, which such an apparatus and mode of observation would possess in point of convenience, cheapness, portability, and expedition, over the present laborious, tedious, and expensive

* Treatise, page 230.

* Math. Dict., Art. Earth.

process, render the attempt well worth making."

The figure of the earth still forms an interesting problem in physical astronomy: nor is it less desirable to ascertain how nearly the results of theory agree with the real state of things. The actual comparison of the weight of a body in different latitudes would appear to afford an additional test on each of these points. My object has been simply to call the attention of competent parties to the subject, and to attempt to facilitate their labours, should they be induced to undertake the task. J. J.

Exeter, February 23, 1849.

THE TABLE.

Lat. of λ' in Degrees	Sin λ'	Sin^2 λ'	Decimal Multipliers from		
			$\frac{230 + \sin^2 \lambda'}{23061304}$	$\frac{186 + \sin^2 \lambda'}{18661304}$	$\frac{194 + \sin^2 \lambda'}{19461304}$
Equator	——	——	·9973416	·9967149	·9968499
1 deg	·017450	·0003045	·9973430	·9967165	·9968515
2	·034899	·0012181	·9973474	·9967214	·9968562
3	·052336	·0027391	·9973535	·9967296	·9968640
4	·069756	·0048659	·9973627	·9967409	·9968749
5	·087150	·0075951	·9973746	·9967556	·9968889
6	·104520	·0109245	·9973890	·9967734	·9969068
7	·121869	·0148521	·9974060	·9967945	·9969262
8	·139170	·0193683	·9974256	·9968187	·9969494
9	·156430	·0244704	·9974480	·9968460	·9969756
10	·173640	·0301509	·9974724	·9968764	·9970048
11	·190810	·0364084	·9974995	·9969100	·9970303
12	·207910	·0432266	·9975291	·9969465	·9970720
13	·22495	·0506026	·9975611	·9969860	·9971103
14	·24192	·0585253	·9975954	·9970285	·9971506
15	·25881	·0669827	·9976321	·9970738	·9971941
16	·27563	·0759719	·9976711	·9971202	·9972346
17	·29237	·0854804	·9977123	·9971729	.9972886
18	·30901	·0954872	·9977557	·9972266	·9973406
19	·32556	·1059894	·9978012	·9972828	·9973945
20	·34202	·1169777	·9978489	·9973417	·9974510
21	·35836	·1284619	·9978986	·9974033	·9975100
22	·37459	·1403252	·9979501	·9974668	·9975710
23	·39073	·1526699	·9980037	·9975330	·9976344
24	·40673	·1654293	·9980590	·9976016	·9977000
25	·42261	·1785993	·9981161	·9976797	·9977676
26	·43837	·1921683	·9981749	·9977446	·9978374
27	·45399	·2061069	·9982354	·9978193	·9979090
28	·46947	·2204021	·9982974	·9978959	·9979824
29	·48480	·2350311	·9983608	·9979743	·9980576
30	·50000	·2500000	·9984257	·9980545	·9981448
31	·51503	·2652559	·9984919	·9981363	·9982128
32	·52991	·2808047	·9985593	·9982732	·9982928
33	·54463	·2966219	·9986279	·9983044	·9983741
34	·55919	·3126935	·9986975	·9983905	·9984566
35	·57357	·3289826	·9987682	·9984778	·9985404
36	·58778	·3454854	·9988398	·0985662	·9986252
37	·60181	·3621753	·9989121	·9986557	·9987109
38	·61566	·3790373	·9989853	·9987460	·9987970
39	·62932	·3960437	·9990590	·9988371	·9988848
40	·64278	·4131662	·9991332	·9989289	·9989729
41	·65605	·4304017	·9992080	·9990213	·9990615
42	·66913	·4477349	·9992831	·9991143	·9991505
43	·68199	·4651104	·9993585	·9992067	·9992398
44	·69465	·4825387	·9994341	·9993006	·9993294
45	·70710	·4999905	·9995097	·9993942	·9994191

Lat. of λ′ in Degrees	Sin λ′	Sin² λ′	Decimal Multipliers from $\frac{230+\sin^2\lambda'}{230\cdot61304}$	$\frac{186+\sin^2\lambda'}{186\cdot61304}$	$\frac{194+\sin^2\lambda'}{194\cdot61304}$
46	·71933	·5174357	·9995854	·9994876	·9995087
47	·73135	·5348729	·9996176	·9995811	·9995983
48	·74314	·5522571	·9997364	·9996742	·9996876
49	·75470	·5695721	·9998114	·9997665	·9997766
50	·76604	·5868173	·9998862	·9998594	·9998652
51	·77714	·6039466	·9999605	·9999512	·9999527
52	·78801	·6209597	1·0000343	1·0000424	1·0000407
53	·79863	·6378099	1·0001074	1·0001327	1·0001272
54	·80901	·6544972	1·0001797	1·0002221	1·0002131
55	·81915	·6710068	1·0002509	1·0003106	1·0002927
56	·82903	·6872908	1·0003211	1·0003978	1·0003815
57	·83867	·7033374	1·0003915	1·0004838	1·0004639
58	·84905	·7191888	1·0004607	1·0005688	1·0005454
59	·85716	·7347233	1·0005276	1·0006574	1·0006252
60	·86602	·7499907	1·0005938	1·0007333	1·0007037
61	·87461	·7649427	1·0006586	1·0008139	1·0007850
62	·88294	·7795831	1·0007221	1·0008924	1·0008557
63	·89100	·7938811	1·0007841	1·0009690	1·0009251
64	·89879	·8078235	1·0008446	1·0010433	1·0010008
65	·90630	·8213797	1·0009034	1·0011164	1·0010705
66	·91354	·8345554	1·0009605	1·0011870	1·0011382
67	·92050	·8473203	1·0010159	1·0012554	1·0012038
68	·92718	·8596628	1·0010694	1·0013215	1·0012672
69	·93358	·8715717	1·0011211	1·0013853	1·0013284
70	·93969	·8830174	1·0011706	1·0014467	1·0013872
71	·94551	·8939892	1·0012183	1·0015055	1·0014436
72	·95105	·9044962	1·0012638	1·0015618	1·0014976
73	·95630	·9145097	1·0013072	1·0016154	1·0015490
74	·96126	·9240208	1·0013480	1·0016664	1·0015979
75	·96592	·9330015	1·0013874	1·0017145	1·0016440
76	·97029	·9414627	1·0014241	1·0017599	1·0016875
77	·97437	·9493969	1·0014585	1·0018024	1·0017278
78	·97814	·9567579	1·0014904	1·0018418	1·0017661
79	·98162	·9635779	1·0015201	1·0018784	1·0018012
80	·98480	·9698311	1·0015447	1·0019119	1·0018333
81	·98768	·9755118	1·0015717	1·0019423	1·0018625
82	·99026	·9806149	1·0015939	1·0019697	1·0018887
83	·99254	·9851357	1·0016161	1·0019939	1·0019119
84	·99452	·9890701	1·0016356	1·0020150	1·0019321
85	·99619	·9923946	1·0016449	1·0020328	1·0019492
86	·99756	·9951259	1·0016564	1·0020474	1·0019633
87	·99862	·9972419	1·0016660	1·0020588	1·0019741
88	·99939	·9987804	1·0016726	1·0020671	1·0019820
89	·99984	·9996801	1·0016765	1·0020718	1·0019867

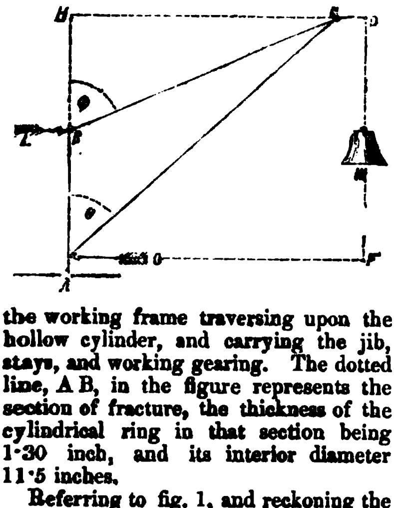
REMARKABLE CASE OF FRACTURE OF CAST IRON CASES.

Sir,—The strength of the materials which enter into our various constructions, whether as forming the members of a machine or the component parts of a building, is a subject which must command attention so long as it is desirable to satisfy the conditions which require a given amount of stability with the least expenditure of stuff. It is under this impression that I venture to trouble you with the minute particulars of *rupture* in a given case, and under certain determinate circumstances which, a short time past, occurred to a number of cast iron cranes erected under my superintendence, and which, upon application of the *test weight*, unfortunately broke down in three consecutive trials.

Had these cranes been designed by any engineer in the subordinate ranks of the profession, or had they been cast out of hand by manufacturers of inferior standing, their failure would, no doubt, be at once attributed to the incompetency of the parties thus concerned; but when we know* that these machines were designed by an old-experienced engineer of high standing, and manufactured by a firm of founders of great respectability and skill, the case presents an incident which, although fortunately upon a small scale, yet may not be altogether without interest to either the professional or mechanical engineer.

As far as I am aware, the machines in question had nothing novel in their figure of construction. Fig. 1 of the accompanying diagrams represents the general form of their framework, and fig. 2 is a sectional representation showing the bottom plate, H H, as lewissed to an ashlar foundation; E E, the upright hollow cylinder bolted to the bottom plate by the circular flanges, C D; F F,

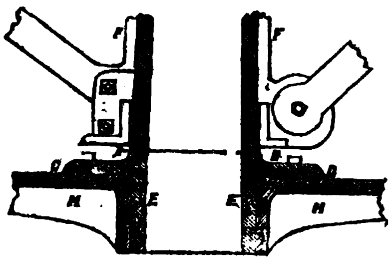
Fig. 1.



the working frame traversing upon the hollow cylinder, and carrying the jib, stays, and working gearing. The dotted line, A B, in the figure represents the section of fracture, the thickness of the cylindrical ring in that section being 1·30 inch, and its interior diameter 11·5 inches.

Referring to fig. 1, and reckoning the distances in inches, AE=2, EB=61, EF=192, FD=136, EC=223, BC=192, and CD=15 inches respectively, measured in the axis of each member. The weight suspended from the point D was 4816 lbs.; but, in addition to this, the weight of the sheave at D, with that of the chain and a portion of the jib and stays, when reduced to the point D, was found to be 543 lbs., making in all W= 4816 + 543 = 5359 lbs. the effective weight acting at D.

Fig. 2.



Upon the application of the test weight W, it was quite apparent that the requisite amount of strength had not been provided, as the weight had not sufficient time to bear with its whole force, before the hollow cylinder snapped off in the line A B (fig. 2). It was conjectured that the accident might have arisen from some flaw in the casting, although the surface of fracture presented no decidedly bad appearance, and therefore another casting of the same dimensions was prepared; it, however, met with precisely the same fate as the first; as did also a *third*, which the contractors persisted in having submitted to the same test. The castings were specified to be "of the best description of No. 2 pig iron, cast from the cupola free from sand cracks and all other defects." The whole weight (exclusive of the test) resting upon the stem at E was 3 tons.

Taking the foregoing data, which have been accurately ascertained, your readers will be enabled to make their own calculations, each according as his judgment may direct. I believe, however, the following investigation includes all the influential elements of the case. Referring to fig. 1, the frame, ABCD, being supposed rigid, let the weight, W, be applied at D; its moment about the point *c*, is W. C D, which moment is resisted at B. Putting BC=a, CD=l, and $\angle$CBH=ϕ, we have for the tension in EB,

$$W.\frac{l}{a.\sin.\phi}\text{..........} \quad (1.)$$

* I send you herewith the names of the parties referred to.

The whole pressure upon the point C, is the tensile force in EB together with the weight W ; ∴

$$W.\frac{a.\sin\phi+l}{a.\sin\phi} \dots\dots\dots\dots (2)$$

is the whole load upon the point C ; and the force of compression in CE is ∴

$$W.\frac{a\sin\phi+l}{a\sin\phi.\cos\theta}; \dots\dots\dots\dots (3)$$

in which θ is the angle CE makes with the vertical; while the tension in BC is represented by the expression

$$W.\frac{a\sin\phi+l}{a\sin\phi.\cos\phi} \dots\dots\dots\dots (4.)$$

Taking W_1 to represent the whole weight of the crane and its gearing, and W_2 the applied weight, the force of compression upon the stem AE is

$$W_1+W_2 \dots\dots\dots\dots (5).$$

Resolving the forces in (3) and (4) in the horizontal and vertical directions, and pulling H and h respectively to represent the thrusts at B and E we have

$$H=W.\frac{a.\sin\phi+l}{a.\cos\phi} \dots\dots\dots\dots (6.)$$

And,

$$h=W.\frac{a.\sin\phi+l}{a.\sin\phi}.\tan\theta \dots\dots\dots\dots (7.)$$

It is obvious that the horizontal thrusts indicated in (6) and (7) act in contrary directions, the thrust at E acting in the direction OE, whilst that at B acts in LB.

From expression (2) the moment of the pressure on C, about the point E is W. $(a\sin\phi+l)$, and that of the thrust represented in (6) about the same point is

$$W.\frac{a\sin\phi+l}{a.\cos\phi}..,$$

in which β is taken to represent the distance EB. Now, these two forces conspire to turn the frame about the point E, and tend directly to produce rupture in the stem at that point; their sum which is represented by

$$W.\frac{a\sin\phi+l}{a.\cos\phi}.C.\cos\theta,$$

(EC=C) must in case of equilibrium, equal the elastic forces of the material called into action by the cross strain; so that if R= the aggregate of the moments of the elastic forces upon the section of rupture, about the axis of rupture, then,

$$R=W.\frac{a\sin\phi+l}{a.\cos\phi}.C.\cos\theta. \dots\dots (8.)$$

Let r represent the mean radius of the cylindrical ring, δ its thickness, and s the modulus of rupture for cast iron ;—then it may be shown that

$$R=S\,\pi.\left(\frac{r^2+\frac{1}{4}\delta^2}{r+\frac{1}{2}\delta}\right).r\delta \dots\dots\dots\dots (9.)$$

Substituting therefore this value of R in equation (8) and solving for S, we shall obtain.

$$S=W.\left\{\frac{(a\sin\phi+l).(c.\cos\theta).(r+\frac{1}{2}\delta)}{\pi r\delta(r^2+\frac{1}{4}\delta^2).(a.\cos\phi)}\right\} \dots\dots\dots\dots (10.)$$

By substituting in equation (10) the numerical values given in the preceding part of this paper, we shall find the value of S=12486 ; about *one-third* that usually assigned for medium cast iron when subjected to no other force than that arising from direct cross stain.

Substituting again in equation (9) the inferior value of S thus deduced, and solving in respect to δ (the mean rad. remaining the same) we shall also find that under the peculiar circumstances of the case, the thickness of the cylindrical ring would require to be 4·10 inches for mere equilibrium, instead of 1·30 inches, the thickness actually provided.

I have no reason to suppose the castings repeatedly prepared by the contractors were inferior in quality, although the foregoing investigation would show them to have been doubtful; but it must be observed that the section of fracture was subject to *two* other forces besides the cross strain, namely, a compressing force (equation 5) of 12079 lbs. on an area of 46 square inches; and a horizontal thrust (equation 7) of 1276 lbs. I am however unable to see how these latter forces any way combined with the cross strain, could account for the apparent discrepancy between the true value of S as found in published tables, and that resulting from the foregoing calculations.

Respectfully yours,

T. SMITH.

Bridgetown, Wexford, April 28 1849.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING 4TH OF MAY.

James Burrows, of Haigh, near Wigan, Lancashire, engineer and draughtsman, and George Holcroft, of Manchester, consulting engineer. *For certain improvements in and applicable to steam-engines, in the machinery and apparatus belonging thereto, in the construction and arrangement of boilers for the generation of steam, and in the furnaces and flues connected therewith, parts of which improvements are also applicable to other similar purposes.* Patent dated October 26, 1848.

The first of these improvements consists in arranging the cylinders of compound engines, (that is where a high pressure cylinder and a condensing cylinder are used in conjunction,) so that the length of the ports leading from the one cylinder into the other shall be the shortest possible. To effect this object the patentees cause the piston-rod of the smaller or high-pressure cylinder to pass downward through the floor of the engine house, where it is connected to a beam, the power communicated to which is again transmitted to the beam above the cylinders (which is directly acted upon by the piston-rod of the low pressure or condensing cylinder) by a connecting-rod. The claim under this head is to reduce the length of the passages in compound engines to a minimum by causing the piston rods of the two cylinders to travel in opposite directions.

The next improvement is an arrangement of gearing and cams to effect a variable opening of the expansion valve so as to admit a greater or less amount of steam as may be required. A rod from the governor is connected by levers and gearing with the cams for opening the expansion valve, so as to make those cams to slide along the shaft by which they are made to rotate; and as the cams are somewhat of a conical, and not of a step form, as usual, according as they are pushed the one way or the other, so they will retain the expansion valves a longer or shorter time open. These arrangements form the subject of the second claim.

The improvements in furnaces relate to the means employed to project the coals upon the fire. A hopper is placed in front of the fire-place from which the coals are regularly fed in by means of two toothed rollers turning very slowly. Beneath the feed rollers, and within a case, there is placed a disc or plate of metal, the edges of which are slightly curved upwards; this plate is fitted upon the end of an upright shaft, by which it is made to rotate in a horizontal plane and at some considerable velocity. As the coals drop upon the revolving disc, they are immediately projected from its surface on to the fire-bars by the centrifugal force communicated to them by the disc. The disc is made to revolve by means of bands and pulleys, the rotation being continued a short time in one direction, and then by means of self-acting apparatus an equal length of time in the reverse direction, which causes an equal distribution of the coal over the surface of the fire-bars. The arrangements described for projecting the coals evenly upon the surface of the fire-bars form the third claim.

A fourth improvement relates to rotary engines, and consists in making them with three pistons or vanes, which are connected to separate shafts, the one shaft being concentric to or inclosed within the other, and the three shafts being connected outside by three cranks to another shaft which is eccentric to the engine shaft. These peculiarities constitute a fourth claim.

The last improvement and claim specified consists in having the cylinder of a steam-engine fitted with three pistons, of which the top and bottom ones are connected together, and only move through a portion of the stroke; their office being to act as valves and points of resistance to the back pressure of the steam employed to give motion to the central piston.

William Brown, of Cambridge-heath, Middlesex, weaver. *For improvements in manufacturing elastic stockings and other elastic bandages and fabrics.* Patent dated October 26, 1848.

These "improvements" in manufacturing elastic fabrics, &c., such as stockings, knee-caps, bandages, consist in the employment of silk and India rubber threads, which are combined and woven together so as to form a circular web and without seam, according as the desired shape may require. The loom employed in the fabrication of this improved article is of the Jacquard description, using a reed of 50 dents to an inch, and one cord to each dent, and four lashes to each cord. A diagram or pattern of the article to be woven, requires in the first place to be formed, so that the proper shape may be given; and the length of the reed employed must be three times that of the finished or wearing size of the article. The stockings thus made are, as they come off the loom, three times the size actually required; they are then submitted to the action of heated air until they shrink to the proper size, according to the usual method of giving elasticity to such fabrics. The patentee claims the arrangements which are described for the manufacture of elastic stockings, knee-caps, bandages, &c.

William Longmaid, of Beaumont-square, Middlesex, gentleman. *For improvements in treating the oxides of iron, and in obtaining products therefrom.* Patent dated October 26, 1848.

Oxide of iron is mixed with from 10 to 15 per cent. of carbon, such as resin or tar. The mixture is put into a retort, and kept at a red heat for two hours after it ceases to give off gas, which gas may be used for illuminating purposes. The carbonaceous compound remaining in the retort is a black pigment, which, being ground up with oil, may be used as a black paint.

Claim.—The above-described treatment of the oxides of iron, for the production either of a black pigment, or of gas to be used for illuminating purposes.

William Church, C. E., and Thomas Lewis, Woollendrapers, both of Birmingham. *For a certain improvement or certain improvements in machinery to be employed in making playing and other cards, and also other articles made wholly or in part of paper or pasteboard, part or parts of which said machinery may be applied to other purposes where pressure is required.* Patent dated October 26, 1848.

The patentees describe—

1. Certain machines for cutting cardboard into lengths and breadths of cards, and for punching them with rows of holes when intended to be used as button cards. The cutting longitudinally is effected by serrated rollers, and transversely by shears. The perforation of the button cards is effected by an oscillating bar employed, which carries a number of punches which pierce the holes.

2. A pressing machine, in which the power is applied to a series of toggle-jointed levers by means of a screw. The toggle-jointed levers are placed between the top sill and the platten of the press.

Claim.—The above-described machinery for cutting cards or paper, and the pressing machinery.

Peter Fairbairn, of Leeds, York, machine maker. *For improvements in machinery for heckling, carding, drawing, roving, and spinning flax, hemp, tow, silk, and other fibrous substances.* Patent dated October 26, 1848.

The patentee claims—

1. The using of a rotary gill between the holding and drawing rollers, so that the sliver shall, in passing through the pins of the rotary gill, form a tangent to the circle of rotation, and near to the bite of the holding rollers; the object being to open the fibres without deranging the form of the sliver.

2. The connecting the upper and under sets or pairs of the driving, and also those of the drawing rollers, so that the sliver may be made to pass at a uniform rate over the surface space of the respective pairs of rollers.

3. The using of gills in drawing machinery of any description, in machines for carding tow, short flax, or other similar material.

4. The employment of a case for covering the rubbing rollers, which case also serves to throw them in and out of gear, while it protects the fingers of the workers.

5. A pall and ratchet-holder, by which the drawing rollers are kept in contact.

6. Certain radial arms upon which the wheel gearing of certain spinning machines, described and illustrated by drawings, are mounted, and by which they are also regulated.

James Clark, of Glastonbury, Somerset, manufacturer. *For improvements in the manufacture of boots, shoes, and clogs.* Patent dated October 26, 1848.

The *first* of these improvements consists in making clogs or goloshes with an intervening elastic junction at the centre of the foot, so that they may retain their place upon the foot. This is effected by making the clog in two pieces, one piece for covering the front of the foot, the other the back part. The two are joined by a strip of sulphurized caoutchouc.

A *second* improvement consists in making the clogs adhere to the foot by prolonging the heel-part upwards and having a spring inwardly, so as to grip the heel or ancle.

And, *thirdly*, shoes are made waterproof by forming the lower part of a thin sheet of gutta percha which comes up on each side of the foot between the lining and the upper.

Robert Walter Winfield, of Birmingham, manufacturer. *For certain improvements in the construction and manufacture of metallic bedsteads, couches, and sofas.* Patent dated November 2, 1848.

The improvements claimed are, *first*, the making of a neck or shoulder upon the upright tubes or pillars of metallic bedsteads, the shoulder being formed at that part where the block for supporting the rails is to be cast.

Second. An addition of two screws to the dovetail joint.

Third. An improved joint for connecting the rails to the blocks of the standards of metallic bedsteads and couches.

Fourth. An improved method of stretching the metallic laths; which consists in uniting them on one side to an auxiliary rail.

Fifth. The casting on of the ornaments after the parts of metal bedsteads have been riveted together.

Sixth. The constructing of metallic plate mouldings for bedsteads.

WILLIAM WEILD, Manchester, mechanical draughtsman. *For certain improvements in machinery for spinning cotton, and other fibrous substances.* Patent dated November 2, 1848.

The improvements sought to be secured under this patent are,

1. The combination, arrangement, and adaptation of mechanism or apparatus for taking out and bringing in the carriages of mules and other machines of a like nature, used in spinning cotton and other fibrous substances.

2. The mechanism or apparatus for winding the chain on to the winding-on barrel during the going out.

3. The arrangement and adaptation of mechanism or apparatus for moving the spindles and regulating the yarn.

4. The arrangement of apparatus for effecting the backing out.

5. The adaptation and application of mechanism or apparatus for latching and unlatching the carriages of self-acting mules when at the extremity of the run out.

6. The combination and arrangement of the spindle and flyer, and the various mechanical parts connected therewith for spinning the yarn and winding it on to the spindles of throstles.

7. A contrivance for regulating the drag upon the spindles of the throstles.

8. The arrangement and adaptation of mechanism to facilitate the doffing of the cops or bobbins from the spindles of the throstles.

The claims, which are eight in number, embrace the improvements specified under these different heads.

MEYERS JACOBS, Spitalfields, Middlesex, gentleman. *For certain improvements in the manufacture, stamping, and treatment generally of woven fabrics of all kinds.* Patent dated November 2, 1848.

The patentee remarks that his invention consists in the mode of combining and applying the following colouring mixtures; and that, although he is altogether ignorant of the nature of the materials and mode of preparing them, which constitute the principal ingredient of his compositions, namely, the mordant, it may be readily obtained from colour manufacturers in Paris. His colouring mixtures are prepared as follows:—

Firstly. For printing or stamping muslins, 10 lbs. of mordant, 1 lb. sweet turpentine, 2 lbs. of boiled linseed oil, 4 oz. of oil of cloves, 1 lb. of dryers, and a sufficient quantity of colour to produce the required shade.

Secondly. In treating trellislike fabrics, such as net or lace, the same composition as the first is used with the substitution of 2 lbs. of white varnish for the boiled linseed oil.

Thirdly. In treating woollen fabrics, the first composition is used with the substitution for boiled linseed oil, of spirit of sal-amoniac in sufficient quantity to be determined by practice and the quality of the fabric.

To apply these colours the patentee employs a trough partly filled with water, which supports a board padded upon its top surface. The composition is laid on this pad by a brush, and the engraved block pressed upon it. The resilliency of the water forces the pad into contact with the projecting parts of the block which are thereby coated. The muslin, &c., is laid on a suitably prepared pad and the design transferred thereto in the usual way.

Imitation lace is produced by passing the trellis-like fabric, after it has been stamped with the second composition, into a drum, and above a band supporting flock or floss, which is beaten up into contact with and adheres to the design. The other side may be exposed to the same process, and the fabric withdrawn, having the design upon both sides, and hung up to dry.

An imitation velvet, which the patentee terms "Utrecht cloth," may be produced by covering a suitable fabric with this composition, and then coating it with a thin layer of liquid India-rubber, after which it is to be flocked as usual.

Claims.—1. The composition, mixture, or combination of materials used to coat or moisten the designs or figures carved upon blocks used in the printing or stamping of muslin or other light woven fabric.

2. The composition, mixture, or combination of materials used in the printing or stamping of trellis-like fabrics, usually called lace.

3. The composition, mixture, or combination of materials used in the treatment, stamping, or printing of woven fabrics of wool or other like material.

4. The composition, mixture, or combination of materials used in the production of "Utrecht cloth."

5. The various processes by which, in conjunction with the composition, mixture, or combination of materials together with flock or floss, raised designs are produced upon both sides of a woven fabric during the same operation. Also the process by which the "Utrecht cloth" is produced.

CHARLES DAWSON, Hardinge-street, Islington, professor of music. *For certain improvements in musical instruments, and in apparatus to be used in connection with musical instruments.* Patent dated November 2, 1848.

The improvements sought to be secured under this patent are as follows:—

1. A flute constructed of two tubes, sliding perfectly air tight one within the

other. The outer tube is furnished with a number of lateral chambers, each provided with two holes, one to be stopped by a key or finger, and the other to open communication with the inner tube, which is perforated with a number of corresponding holes. The tube is caused to slide up or down by a lever arrangement, to be worked by the fingers, according as it is desired to increase or diminish the pitch of the note. Or, a sliding perforated plate may be substituted for the moveable tube, and interposed between the tube and the lateral chambers.

2. The flute may be constructed of metal in a curved form, and with a longitudinal slot, and a valve fitting into it composed of spiral springs covered with India-rubber, or of India-rubber alone. The valve is arranged so as to close the slot perfectly air-tight, and yet, when depressed, to leave a space between the sides of the slot and the valve, whereby the note is produced. The patentee remarks that this mode of construction, which allows the orifice to be made at any desired part, enables the performer to produce, with great facility, tones and semitones according to pleasure.

3. In order to prevent wrong keys being brought into play in teaching, through the carelessness of the pupil, a roller is placed behind the name board and centre pins. It is divided according to the diatonic scale, and fitted with a suitable number of projections, which, when brought above their corresponding keys, maintain them in position. The roller carries at one end a bevelled wheel, gearing into another bevelled wheel keyed upon a spindle, which projects beyond the name board, and carries a pointer, whereby the roller may be made to act upon such of the keys as may be required.

4. Above the octave notes, or such others as it may be desirable to sound together, there are placed small keys attached to arms, which are made fast to the ends of their respective spindles, so that on depressing one key, its octave, or other corresponding key, will also be depressed through the intervention of the spindle.

5. In order to regulate the admission of air to the pipes of organs and other like musical instruments, a sheet of paper suitably perforated, is drawn by a pair of rollers between two horizontal boards, and also between the air channels and air chamber. The edges of the boards are made with indentations and corresponding projections, and the bottom one is supported upon a crossbar, which is connected to the valves, so that when a thin material is passed between their edges, it thereby prevents the entry of the projections into the notches, and the valves will be forced down. When the perforated paper passes between the perforations in the air chamber, and the ends of the air channels leading to the pipes, such pipes only will be sounded as have the ends of their corresponding channels brought into communication with the air chamber by the perforations in the paper.

Claims.—1. The mode or modes of producing notes in flutes and other similar wind musical instruments by means of a moveable tube or plate.

2. The mode or modes of producing notes in wind musical instruments by means of a longitudinal valve or valves.

3. The mode or modes of constructing apparatus for preventing the action of some of the keys of musical instruments.

4. The mode or modes of constructing additional keys or apparatus to be applied to the ordinary key-boards of musical instruments, to enable the performer by a single movement of a finger to produce two or more notes.

5. The mode or modes of constructing apparatus for admitting and regulating the admission of air to the pipes and other parts of musical instruments.

Soren Hjorth, heretofore of Jewry-street, Aldgate, in the City of London, but now residing at No. 2, Shaftesbury-crescent, Vauxhall-road, Pimlico. *For certain improvements in the use of electro-magnetism, and its application as a motive power, and also other improvements in its application generally to engines, ships, and railways.* Patent dated October 26, 1848.

For specification see the first article of this Number.

William Bullock Tibbits, of Braunston, Northamptonshire. *For certain improvements in obtaining, applying, and controlling motive power, parts of which improvements are applicable to the raising and forcing of liquids.* Patent dated November 2, 1848.

The improvements consist,

1. Of a new arrangement for obtaining direct rotary motion—in other words, a new rotary engine.

2. A feathering paddle wheel.

3. Two arrangements for working railway breaks. And

4. A pump on the same plan as the rotary engine for raising and forcing liquids.

The description of the first and third and fourth branches of this invention we shall give in a future Number.

Claims.—Each of the branches of the invention in its peculiar features.

Alfred Vincent Newton, of 66, Chancery-lane, mechanical draughtsman, *for certain improvements in the manufacture of steel.* Patent dated November, 2, 1848.

Iron is placed in a furnace and covered with charcoal, upon which is placed a cover,

luted down so as to prevent the admission of the external air. It is furnished in front with a tuyere hole, and communicates at back with a chimney. In front of the furnace are placed two receptacles, filled with charcoal or peat, and covered at top and luted down to exclude the external air. Currents of air are driven into the receptacles, whence they pass in the form of gaseous carbon by a common main through the larger hole to the metal in the furnace. A current of air is admitted by a pipe, between the receptacles, to the metal. The supply of gaseous carbon and atmospheric air is regulated by dampers.

Cast iron is prepared to be converted into steel by being first melted once in an apparatus similar to the one just described, by means of a hot carbonic oxide blast. And wrought iron is prepared for conversion by being previously melted once in plumbago crucibles (such as are manufactured by Mr. Dixon, of New Jersey).

Claims.—1. The arrangement and combination of the various parts of the apparatus, whereby the operator is enabled at the same time to refine the metal in the furnace and to force upon it currents of gaseous carbon and atmospheric air, in such manner and quantities as to convert it into steel.

2. The process of making steel by forcing in currents of gaseous carbon and atmospheric air in such quantities as is necessary to keep up combustion in the furnace and receptacles, while currents of gaseous carbon are forced upon the metal in the furnace in such quantities as to keep up the necessary combustion of iron and carbon to produce steel.

3. The previous preparation of iron by melting it with the hot carbonic oxide blast, or in plumbago crucibles, to render the iron capable of being more easily converted into steel.

Richard Bright, of Bruton-street, Middlesex, lamp manufacturer, *for improvements in lamps, wicks, and covers for vessels for holding oil and other fluids.* Patent dated November 2, 1848.

Mr. Bright's improvements embrace several important novelties, to which we cannot do justice without the aid of engravings, for which we must wait till next week. The most striking is, a new mode of steadying the glass chimneys of lamps—the manufacture of hollow cylindrical wicks in a stiffened state ready for use—and a mode of making wicks of two altitudes, so that one or both the parts may be used, according as a weak or strong light is wanted.

James Robertson, of Liverpool, cooper, *for a mode or modes of consuming smoke and other gaseous products arising from fuel and other substances.* Patent dated Nov. 2, 1848.

Mr. Robertson's mode of consuming smoke consists, firstly, in placing perforated horizontal tubes in the place of the bridge and vertical pipes at the back of the boiler furnaces, so that the smoke and products of combustion may pass over and through the heated horizontal tubes to the chimney, and be thereby partially consumed. The combustion is promoted by the heated air which passes up the vertical tubes, and escaping through the perforations, mingles with the products of combustion. And also by a current of air being admitted at the back of the boiler to the smoke passages.

2. The patentee effects the same object in stoves employed to heat apartments, by placing therein a number of horizontal perforated tubes open at one or both ends to the external atmosphere, so that it may be admitted in a heated and divided state to mingle with the products of combustion.

3. The noxious elements of gases are proposed to be got rid of by passing them through heated serpentine tubes placed inside a stove.

Claim.—The mode or modes of consuming smoke and other gases produced from fuel and other substances as described.

Robert Thomson Pattison, of Glasgow, Scotland, printer, *for an improved preparation or material for fixing paint or pigment colours on cotton, linen, woollen, silk, and other woven fabrics.* Patent dated November 2, 1848.

For specification and claims of this patent see *ante* p. 333.

Charles William Kesselmeyer, of Manchester, warehouseman, and Thomas Mellowdew, of Oldham, in the same county, *for certain improvements in the manufacture of velvets, velveteens, and other similar fabrics.* Patent dated Nov. 2, 1848.

The object of this invention is to produce a deeper pile in cotton velvets, velveteens, &c., than has before been practicable, by using eight, nine, or more warp threads (interwoven with weft threads) instead of six which has been the number hitherto employed.

Claim. — The manufacture of velvets, velveteens, and other similar fabrics, of cotton, linen, or flax, consisting of a combination of eight, nine, or more warp threads interwoven with weft threads as described.

Thomas John Knolys, of Heysham Tower, near Lancaster, Esq., *for improvements in the application, removal, and compression of atmospheric air.* Patent dated November 2, 1848.

The first of these improvements relates to the means employed to remove the heated air, gases, &c., from apparatus used in roasting coffee and chicory. The patentee uses vessels of earthenware or enamelled

iron, and prefers that the vessels should be octagonal or angular, instead of cylindrical, and completely perforated throughout. The heated vapours are sent through the chamber in which the perforated vessel is made to rotate, which causes the vapours to be speedily driven off through the perforated cylinder from the coffee being roasted. Earthenware trays may be used in place of the revolving vessels.

A second improvement relates to a furnace which formed the subject of a former patent granted to the patentee, and consists in making slits or openings in the bottom of the earthenware lumps or blocks forming the bottom of the furnace.

A third improvement consists in using hollow furnace bars in furnaces, through which the cold air is impelled, to preserve the bars from being speedily wasted.

Claims.—Each of the three improvements as described.

James Hart, of Bermondsey-square, engineer, *for improvements in machinery for manufacturing bricks and tiles, parts of which machinery are applicable to moulding other substances.* Patent dated Nov. 2, 1848.

The first improvement described consists of a portable machine for washing clay. A hollow wooden trough, mounted on wheels, carries a revolving axle with a series of steel blades, which project into the midst of the semifluid mass of clay and water.

A second improvement consists in the use of two eccentric rollers, the longest radius of the one roller coming opposite the shortest radius of the other, which causes the rollers not only to crush the clay, but to produce a grinding action at the same time.

A third improvement relates to the construction of a wheel machine for moulding bricks. First there is a hopper, in which the clay is partially pugged by revolving blades; next, a set of brick moulds, which form an endless chain, which runs under the hopper; thirdly, a series of diagonal scrapers for levelling the surface of the bricks upon the moulds; and fourthly, a revolving brush for cleaning and wetting the moulds.

Claims.—1. The portable washing machine, as described.

2. The application of eccentric crushing rollers for preparing clay.

3. The machine and the various parts thereof described, namely—the endless chain of mould, the diagonal scrapers, the revolving brushes, and the addition of wheels.

Francis Gybbon Spilsbury, of St. John's Wood, gentleman, *for improvements in paints and pigments.* Patent dated November 2, 1848.

Claims.—1. The manufacture of paints and pigments from lead by the application of tungstic acid.

2. The manufacture of paints and pigments by the application of soda potash and oxides of iron.

3. The manufacture of paints and pigments by the application of tungstate of iron and manganese.

4. The manufacture of paints and pigments from lead, by the application of antimonious and antimonic acids.

5. The manufacture of paints and pigments by the application of the products of bitter aloes, acted upon by acetic or nitric acid.

George Arthur Biddle, of Ipswich, engineer, *for improvements applicable to gas-burners.* Patent dated November 2, 1848.

The object of this invention is the equalizing of the light of gas-burners by means of a self-acting apparatus, so that under varying pressures of gas the light may be steady. The apparatus consists of an arrangement similar in principle to that of the gridiron or compensation pendulum of a clock. It is composed of a steel rod fixed within a brass tube occupying a central position within the flame of an argand burner. The greater or less heat produced by the increase or diminution of the flame causes the steel rod to act by expansion or contraction upon a lever connected with a valve attached to the supply pipe, which regulates the supply of gas accordingly.

Claims.—The arrangements whereby the expansion of the combined pieces of metal are made efficacious in regulating the supply of gas to the burner, and the employment of a valve for stopping off the gas instead of a stop cock.

And the valve, in so far as its upward movement, is calculated to nearly stop off the flow of gas.

And also a long ground bearing for the valve spindle to be used instead of a stuffing-box.

John Harris, of Richard's-terrace, Rotherhithe, Surrey, engineer, *for a mode or modes of founding type, and of casting in metal, plaster, and certain materials.* Patent dated November 2, 1848.

The improvements set forth in the specification and drawings of this patent show various arrangements for type founding, and for casting in such metals, as iron pipes, balls, and cylinders. The peculiar feature of the invention is the placing a trough or open space below the level of the mould into which there is left an open passage, or set of passages, which communicate with the interior of the mould, and are so arranged that by drawing a slide they may be shut up at pleasure. The molten metal is run into the mould until it may be supposed that the air, scoria, or sand is completely driven out. The slide is then drawn so as to stop

the outflow of the metal. The patentee states that this arrangement completely insures the soundness of the casting and the prevention of air-bubbles.

Claims.—The arrangements described as employed in the process of moulding and casting.

Richard Archibald Brooman, of Fleet-street, London, gentleman, *for certain improvements in the manufacture of hinges, and the machinery or apparatus used therein.* (Communication.) Patent dated November 2, 1848. (For specification and claims see *ante*, page 385.)

WEEKLY LIST OF NEW ENGLISH PATENTS.

James Wilson, of Old Bond-street, tailor, for improvements in trusses. May 1; six months.

* James Godfrey Wilson, of Milliman's-row, Chelsea, engineer, for certain improvements in the manufacture of glass, and in machinery and apparatus connected therewith. May 1; six months.

Alexander Munkittrich, of Manchester, merchant, for an improved composition of matter, which is applicable, as a substitute for oil, to the lubrication of machinery, and for other purposes. (Being a communication.) May 1; six months.

John Dalton, of Hollingworth, Cheshire, calico-printer, for a certain improvement or certain improvements in printing calicoes and other surfaces. May 1; six months.

Samson Wooller, of Bradford, York, manufacturer, for certain improvements in machinery or apparatus for weaving. May 3; six months.

Thomas Wentworth Buller, of Sussex Gardens, Hyde Park, Middlesex, Esq., for improvements in the manufacture of earthenware. May 3; six months.

Matthew Kennedy, of Manchester, cotton spinner, for certain improvements in the method of packing cops of cotton and other fibrous materials, and in the apparatus connected therewith. May 3; six months.

Thomas Whaley, of Chorley, Lancaster, coal proprietor, and Richard Ashton Lightoller, of the same place, cotton spinner, for certain improvements in machinery or apparatus for manufacturing bricks and tiles from clay or other plastic materials. May 3; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subject of Design.
April 26	1863	John Goodman, M.R.C.S.	Manchester	Hydro vapour bath.
"	1864	Samuel Grew and Jas. Crawford	Rugby	Cramp for coupling and uncoupling railway carriages.
27	1865	Samuel Beston	Aldersgate-street	Life-preserver braces with air-tight mouth-pieces attached—adapted for other uses.
"	1866	Samuel Fox	Gracechurch-street	Telescopic pencil or pen-holder.
28	1867	William Breyaton	Norfolk-street, Strand	Portable oven.
"	1868	Michael H. Crichton	Edinburgh	Apparatus for securely holding brooches.
"	1869	M'Adam, Brothers, and Co.	Soho Foundry, Belfast	Beater or scutcher for dressing flax and other fibrous plants from the straw, and separating the fibre from the woody parts.
"	1870	Robert Leslie	39, North Frederic-street, Edinburgh	Cutting machine.
30	1871	James Graffley	Sydney-alley, Coventry-street	Fastening for shirt-collars, garments, &c.
"	1872	Meyer, Joseph, and Meyer	21 and 24, Bow-lane, Umbrella and Parasol Manufacturers	Parasol Parisienne.
May 2	1873	James W. Blackburn	Cheapside	Zetetique prize shirt.
"	1874	Josh. Guise	Margaret-street, Wilmington-square	Gas-burner and glass-holder.
"	1875	Thos. H. Pindar	Cheltenham	Combined coat and waist-coat.
3	1876	Thomas Stucley	Turner-street, Commercial-road	Loo-table.

NOTICES TO CORRESPONDENTS.

The extraordinary number of specifications enrolled during the last week (23), of all of which abstracts will be found in our preceding pages, has necessarily precluded the insertion of several communications which are in type, and the publication of which we postpone with regret.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1344.] SATURDAY, MAY 12, 1849. [Price 3*d*, Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

HJORTH'S ELECTRO-MAGNETIC MOTIVE ENGINE.

Fig. 10ᵃ.

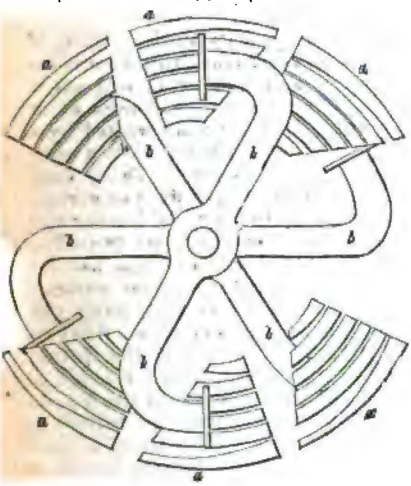


Fig. 10ᵇ.

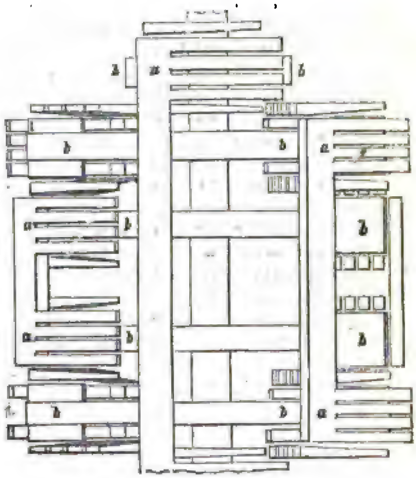
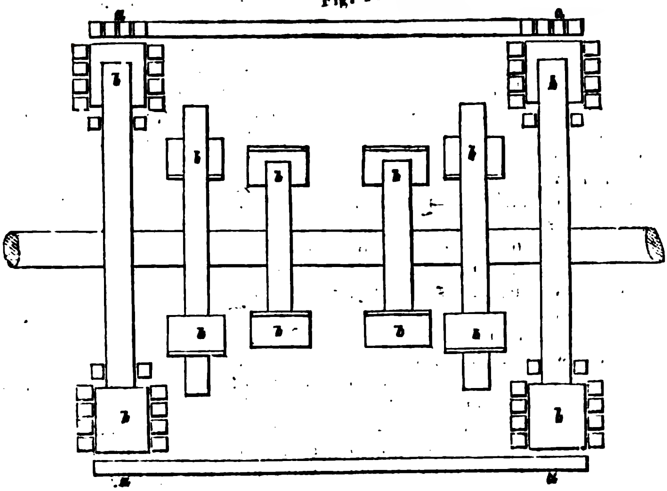


Fig. 10ᶜ.



MR. HJORTH'S ELECTRO-MAGNETIC MOTIVE ENGINE.—(CONCLUDED FROM P. 414.)

I do not confine myself to the use of wrought iron in the magnets or armatures, which may be made of cast iron or other metals, or substances which may be made magnetic. It will also be obvious, that the repulsive, as well as the attractive powers of metals or other substances, may be rendered available for the same purposes by means of apparatus constructed and arranged in a manner similar to that herein described.

The motive power obtained by the arrangements above described, may be employed for all purposes in which power may be required, by the addition of the ordinary apparatus used for such purposes. Thus, the power may be rendered applicable for raising weights, and especially for raising the ram of a pile engine or a heavy hammer. In these cases I should prefer applying a magnet, constructed according to my arrangement, immediately over the ram or hammer connected with it by a wet chain or rope, and moving with it in guides. On the side of the frame or guide, adjusting tappets would be fixed, by means of which the connection with the battery would be cut off at any required portion of stroke.

Figs. 9 and 9^a represent an arrangement by which magneto-electricity is produced in an electro-magnetic, or common locomotive, for the purpose of magnetising the wheels, and thereby increasing the adhesion; *a*, *a*, *a*, are horseshoe-formed permanent magnets, placed so, that the inside part of their poles face a certain number of pieces of soft metal, or electro-magnets, *b*, *b*, *b*, fixed between the spokes of the wheels. As soon as the wheels are set in motion, electricity is induced in the coils surrounding a cylinder of sheet iron, *c*, fixed between the wheels. By this arrangement the cylinder, as well as the wheels, will of course be magnetic, and the magnetic power will be increased in proportion to the speed of the wheels, giving thereby an increased adhesion proportionate to the slipping which may take place from want of weight, or any other cause. The electricity produced in this way may also be made available for moving the engine itself by a number of electro-magnets fixed to the wheels of the engine or carriages, and so revolving by the motion of the train, and brought within the action of fixed permanent magnets, the electricity produced being conducted to the electro-magnetic engine as an auxiliary power. By means of arrangements similar to those just described, an auxiliary power for stationary, or marine engines may be obtained from the magneto-electricity developed by the revolution of fly-wheels, paddle-wheels, drums or working wheels.

Fig. 10 represents another form of commutator or current charger; *a* is the centre or shaft of one set of magnets in an oscillating engine constructed as in fig. 1^a and fig. 1^b, or shaft-worked by a connecting-rod and bell-crank in a common reciprocating engine. To this shaft in each set of magnets is fixed an upright lever, *b*, with two horizontal levers *c* and *c'*, at the ends of which are two cups, *f* and *f'*, with a syphon or tube like the common syphon cups used for lubricating machinery. Below these levers two metallic springs, *d* and *d'*, are fixed to two pieces of wood, *e* and *e'*; the springs are adjusted for the proper amount of "lead" by the set screws, *h* and *h'*, and serve as conductors from the battery to the magnet coil. The lever, *c*, and spring, *d*, are for the forward motion of the engine, and the spring, *d*, is so set that the end of the lever, *c*, is brought into contact with it just before the crank of the engine reaches its "top centre." By this means the electric current from the battery is conducted from the spring, *d*, to the levers, *c* and *b*, and so to the magnet coil, and the power of the engine is excited for the down stroke on the side in question. A corresponding action takes place in the springs and levers connected with the opposite set of magnets. During the forward motion of the engine, the spring, *d'*, is kept completely clear of the motion of the lever, *c'*, by means of a tappet or cam, *w'*, or any ordinary mechanical arrangement. A corresponding arrangement, *w*, is adapted to the other spring, *d*, and in working the engine the two tappets or cams may be worked by one handle, so that the spring, *d*, shall be depressed out of the way, and the spring, *d'*, released into action, and thus the motion of the engine be reversed. In order to avoid the spark, and to facilitate the communica-

Fig. 10.

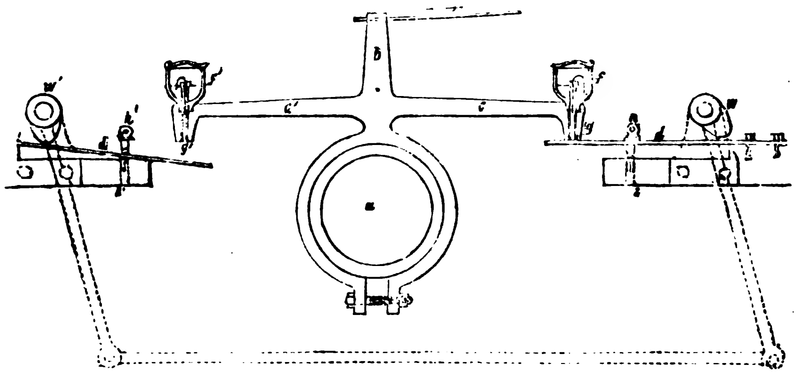


Fig. 11.

Fig. 9ᵃ.

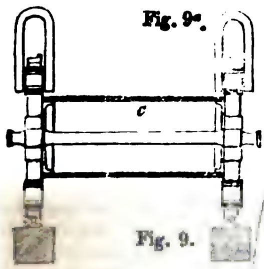
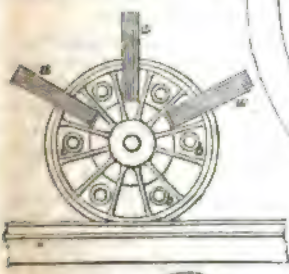
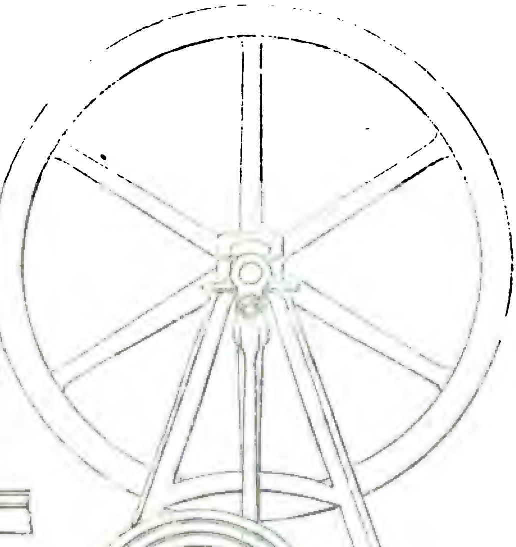
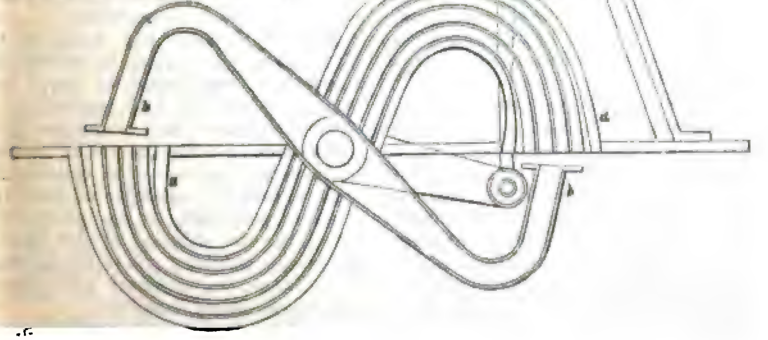


Fig. 9.



tion of the electric current from *d* to *c*, or *d′* to *c′*, diluted sulphuric acid is constantly allowed to drop from the syphon cups, *f* and *f′*, through the tubes, *g* and *g′*, by means of a wick to moisten the surface in contact. A similar arrangement being applied on the other side of the engine, and the springs adjusted so that the touching point or surface of the lever on one side of the engine does not leave the corresponding spring before communication is established on the other side of the engine, the same result is obtained as has already been described in the other form of commutator.

Fig. 10^a represents a side elevation, and fig. 10^b, and fig. 10^c, a plan and section of an arrangement by which a rotary motion with a constant and direct pull, and succession of polarities can be obtained, being one of the modes in which my invention can be applied in and for the construction of a rotary engine. *a a a a a a*, are the stationary magnets here represented as rods of different lengths put together in such a way that they form a case with a slit towards the centre for the arms of moveable magnets, *b*, *b*, *b*, *b*, *b*, *b*. The said rods are to be fixed in such a way that they do not touch one another, and their ends or surfaces form angles with the direction of motion of the moveable magnets; these are to be placed at such a distance from one another, and in such a way that one set of magnets commences to exercise its power before the current passing round or through the other is broken, in order that a constant flow of electricity may be maintained without the current from the battery being broken. The change of the current can be produced by a modification of the common arrangement, of a cylinder of metal worked by the shaft, and inlaid with some non-conducting material, from which the conducting wires extend to the coils surrounding the magnets.

Fig. 11 shows how a semicircular motion, or a reciprocal rotary motion, can be obtained, which may be converted into a rotary motion by cranks. *a* is the stationary, and *b* the moveable magnet. The poles of the stationary magnet form cases, the interior sides of which, or their poles, if built of several bars, form angles with the direction of motion of the moveable magnet. In the said cases may be placed rods of different lengths with corresponding apertures in the moveable magnet. The current may be broken in the same way as described in the oscillating engine represented in the engraving. Two sets of magnets will be ordinarily required, working in opposite directions.

Having now described the nature of my said invention, and in what manner the same is to be performed, I wish it to be understood that I am aware of various attempts having been made to obtain motive power by means of electro-magnetism; I do not, therefore, claim as of my invention the exclusive use of electro-magnetism, nor do I claim the exclusive use of the several parts of the apparatus and arrangements before described and referred to, except when the same are employed in connection with and for the purpose of my said invention. And I hereby declare that what I claim as the invention intended to be secured by the said letters patent is as follows:—

First. I claim the constructing, arranging, and combining magnets in such a way that they exercise their attractive or repulsive power mutually, by a continuous and direct attraction or repulsion upon points presenting themselves successively during the whole stroke, in and for the production of motive power by means of electro-magnetism.

Secondly. I claim the regulating the current of the electric fluid by allowing the same to pass through bodies with surfaces of different dimensions, touching or rubbing upon one another in such a way, that the areas of the said surfaces are diminished or increased by being moved by a governor, thus allowing a greater or smaller supply of the electric fluid to pass, according to circumstances, in and for the production of motive power by means of electro-magnetism.

Thirdly. I claim the changing the direction of the current by means of a commutator constructed as above described, in the use and application of electro-magnetism as a motive power.

Fourthly. I claim the use of electro-magnets adapted to and in combination with engines and carriages on railways, as above described, for the purpose of increasing the adhesion of the wheels, and as an auxiliary power for magnets on railways, or stationary and marine engines, as before described.

Fifthly. I claim the arrangements

before referred to for producing a rotary motion by a direct pull or thrust, and continual succession of polarities, as above described.

Sixthly. I claim the arranging and combining magnets constructed as described, so that a semicircular motion or a reciprocal rotary motion of the moveable magnet may be obtained, and the power transferred thence, either directly to the work or through cranks and connecting rods to a revolving shaft.

Lastly. I claim the combining the several arrangements before described and referred to for the application of electricity as a motive power to engines, ships, and railways.

ON SOME PHENOMENA OF CANDLES.

Sir,—I am about to come out "in a new light," or rather with the improvement of an old one. "*In tenui labor, sed tenuis non utilitas.* There are few greater nuisances to a "reading man" than a "*flickering*" *candle.* Candles, of any sort, are almost out of fashion now-a-days; but after trying several of the modern substitutes, I prefer candles to any of them, even with the great defects which arise from bad manufacture—many of which I cannot help thinking might be avoided by the application of a little more "science;" and one of the most annoying of all—that "flickering" I have just mentioned—may be almost always remedied by the following simple method. *Bend the wick on one side,* at an angle of forty-five degrees or so. This is an old recipe for doing away with the necessity of snuffing; but I have never heard the other and more important benefit mentioned as obtainable by thus inclining the wick. The cause of the two effects is undoubtedly the same. Both the production of a "mushroom" top and the flickering arise from imperfect combustion. The latter phenomenon appears to me to be nothing more than the alternate kindling and extinguishing of the gas which is being continually evolved. The gas takes fire, and then, for want of a due supply of atmospheric air, goes out again—is rekindled and goes out again, and so on, the successive kindlings being accompanied by the slight explosive noise which always accompanies the taking fire of gas. But the bending the wick on one side does not, and cannot, indeed, procure a *very much* greater supply of air than in the upright position; at any rate, it cannot procure a *perfectly* free supply: and without this, the combustion will always be more or less imperfect. Could not some means then be devised by the manufacturer to leave the wick *hollow*, so that, as in the Argand lamp, a stream of air might flow through the centre of the wick itself?

The inclination of the wick on one side, in the manner just mentioned, may cause the tallow or wax, or whatever the candle be made of, to run down or "gutter" on that side; but this may generally be avoided by care. This effect reminds one of the extreme regularity, and even beauty, with which these formations sometimes occur, and to which superstitious people have chosen to give the name of "shrouds" and "coffin-handles." It would be worth while inquiring into the causes producing this regularity—especially the curling inwards, by which the aforesaid "coffin-handles" are formed. Old women and others have watched them often, and attentively enough to be able to give some account of their "rise and progress," one would think; but I fancy the investigation must be undertaken by some one rather less given to be frightened.

There is another simple experiment with a candle worth inquiring into. Every one knows that if anything be held just over the flame, the flame seems to be attracted by it, and leaps upwards every now and then, as if endeavouring to reach the object. The flame is also affected by holding objects near it laterally. Does the object held over the flame *reflect* the unconsumed vapour or smoke downwards, and thus cause it to take fire again, apparently lengthening the flame by so doing? This seems the most probable explanation. Every one knows that the dense smoke of a just extinguished candle may be kindled again by holding a light to the ascending column within a few inches of the wick.

Everything connected with "combustion" is worth investigating, and when we have such varied forms of this action continually going on around us, it seems probable that much might be learnt by attentive observation, if only people would learn to look upon these phenomena as *worth* their attention quite as

much as any other. "Familiarity breeds contempt," and, as the necessary result, science remains imperfect until some one "begins to have an idea" that these things are not altogether so contemptible as they used to fancy. Yours, &c.,

A. H.

THE SYSTEM OF RELAYS OF HANDS IN MANUFACTORIES.

The difficulties and discontents of late so frequent in regard to relays of working hands in manufactories, may render interesting a short account of a mode of relay practised many years ago, and which proved highly advantageous to the manufacturers, at the same time that it proves to the entire satisfaction of the people they employed.

On considering, in the year 1803, the best mode of managing new manufacturing establishments in naval arsenals, Sir Samuel Bentham was anxious to devise some means by which the building and machinery could be put to their fullest use without endangering the health of the operatives. To obtain practical information on the subject, he visited many of the greatest factories of cotton, flax, and other filamentous substances, as well as metal works, as far north as Liverpool and Sunderland, and became convinced that, for a constancy, ten hours of factory labour was the most that could be considered as compatible with robust health. He observed, too, that where work was done by night sets, the people of those sets had a haggard and unhealthy look, and he reflected besides that they were thus deprived of enjoyment of the day and daylight. After much consideration he contrived a mode of working mills continuously, which promised well; and Messrs. Grimshaw, of the Patent Ropery at Wearmouth, undertook to try it, by employing their people in the manner proposed.

His new expedient, where two sets of hands were to be employed, was simply that of altering the hour for the change of hands; instead of one set working all day, and the other all night, he proposed that the change should take place in the middle of the day. Thus, at Wearmouth, the morning set of people left their work at noon; an hour was destined for examination of the machinery; at one o'clock the afternoon set of people came on, having already dined; two half hours were allowed them afterwards for rest and refreshment; at twelve at night covered vans carried this set home, and at one in the morning called up and collected those who had left work at noon; bringing them again to the ropery, and they too had their two half hours of rest also between that time and noon. The people were delighted with this arrangement, for both sets had always a portion of the night for sleep, and a part of every day at their own disposal—the children for school or play, the housewives for their domestic business, the men for gardening or other recreations. Besides this, as the set which left work at noon on Saturday did not come on to work again till one on Monday afternoon, they had a clear eight-and-forty hours to themselves. Many profited of this long holiday to visit friends at Newcastle.

The success which attended this experiment at Wearmouth admitted of no hesitation in Sir Samuel's mind, and he introduced the same mode of working the hands in the metal mills in Portsmouth Dockyard, which, like the wood-mills and millwrights, were as completely left to his management as if they had been his private concerns. The saving by making a double use of the metal mills amounted to 1,500*l.* per annum, being the saving of so much interest on the capital sunk for buildings and machinery.

Savings to a still greater amount may, doubtless, be made in many private factories by putting them to their fullest use. But without going to the extent of the arrangement above described, an approximation to it might prevent much of the loss now sustained by manufacturers, debarred as they are from a continuous use of their buildings and plant. There might be relays of the whole set of working hands, by one set coming on at three or four o'clock in the morning and working till noon; the set to replace them coming to their work at noon, might continue till eight or nine in the evening. Thus, the proprietor would be enabled to derive an interest on his sunk capital, for eighteen hours out of the four-and-twenty, instead of, as at present, only for ten or twelve.

Were the men employed in a manufactory to have their hours of work thus limited to less than ten, their earnings would of course be diminished in proportion; but this might lead to employment of another nature, highly con-

ducive to health, and often to morality—working at field or garden work in the open air. Proprietors would find it advantageous to let out a portion of their land in small allotments, by the cultivation of which the men might obtain ample compensation for any diminution they might sustain of factory wages. The beneficial moral effects of such allotments has been great wherever they have been introduced.

M. A. B.

MOTION OF PLANETS AND AERIAL NAVIGATION.

Sir,—The subject embraced in Mr. De La Haye's communication, inserted in Number 1342 of the *Mechanics' Magazine*, having engaged a little of my attention, I beg to be allowed some space in your valuable miscellany, to make a few remarks upon the "motions of planets" and "aërial navigation;" reserving the principal subject (marine locomotion) for another opportunity, unless some more able reader of your columns should feel disposed to take up the subject.

Although I admit the possibility of the existence of the attraction of the sun towards the various planets of which it forms the centre, still I deny the necessity of such attraction either to support their motion or to keep them in their proper track.

Suppose I could obtain a perfect vacuum in (say) a hollow glass globe; if in this globe I could suspend a ball (like Mahomet's coffin) without any mechanical means; or, in other words, if I could, in this instance, annihilate the attraction of the earth, it is quite clear the ball would continue or remain in any particular part of the globe in which I placed it, whether it touched the globe or not. It would naturally be said by some, that it would fall to the lower part of the globe; but this would be the effect of the attraction of the earth, which I am assuming for the sake of illustration, to be in this case annihilated. Now, if I give this ball a motion round its own centre, it would continue that motion for ever; and in like manner, if I give it several different motions, it must continue each of those motions for ever, for there is nothing to stop it, there is *no friction;* the only bar to perpetual motion being the attraction of the earth which compels us to have recourse to mechanical means for supporting the subject of experiment, and the difficulty of obtaining a vacuum.

Now, let us attempt to imagine under what circumstances the Universe was created. Suppose, first, the sun is placed in a perfect vacuum; next, the various planets in their places, all in a perfect vacuum, without motion and without any attraction for each other, they are in this position perfectly quiescent and incapable of putting themselves in motion. Now, let the sun have a motion given to it round its own centre, and it will continue that motion, of whatever speed, until the same power which gave it puts a stop to it. Again; suppose our planet receives a motion round its own axis, and at the same time another motion round the sun, passing various planets in its course, there is surely no need of attraction from any other planet or any internal power to keep up this motion; there not being an atom of friction for the various planets to contend with, there cannot be any necessity for power to keep them in motion.

Of course, I do not deny that each planet possesses attraction in itself; namely, from its centre to the utmost edge of the lightest particle of air surrounding such planet. With respect to our own planet, consisting chiefly of earth, water, and air, of course the extreme outer surface of the latter (air) is the only part which could meet with friction: but, beyond this, being, as far as we can judge, a perfect vacuum, there can be no friction.

I think the subject of aërial navigation should be treated much in the same manner as locomotion under water would be if carried out; for if we could live under water without supply of any air for a length of time, we should take some fish for the model of our vessel.

This subject seems to have been too generally treated, as though the vessel or machine travelled on the top of the suspending medium, instead of being entirely immersed in it; if it were possible to get to the top or outer edge of the air, an open boat (of course "tarnation" light) would float thereon, the air being first emptied out of it, and the boat would be as little likely to fill with air and descend to the earth as a common boat is likely to founder on water. I cannot therefore see what advantage a rolling motion would give in navigating the air, as the object is to pass through

the air, not over its surface; and a balloon, or vessel, of the form of a sharp-made fish, seems to me to be the best adapted for aërial navigation; it should be just capable of supporting itself, say, 200 feet above the earth, and be provided with machinery connected with wings or screw propellers capable of raising or lowering it at pleasure without expending the gas, and also of propelling and steering it in any direction. The effect of an adverse current of wind upon such a vessel may be imagined by observing a fish above a waterfall attempting to go against the stream.

I confess I am not sanguine enough to expect ever to see the air navigated in a satisfactory manner, as it requires a compact body to limit the resistance, great capacity for support, and great firmness to keep its shape if intended to move with speed, with a giant power to direct and control its motions.

In conclusion, let it be understood, that I do not claim to be the modern Newton mentioned in Mr. De La Haye's letter, and being but a young hand in mechanics, it is probable he may find me at fault in some part of this rambling letter; if so, I hope he will set me right.

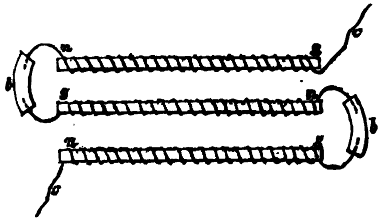
I am, Sir, yours, &c.

T. Moy.

1, Clifford's-inn, May 1, 1849.

MUSCULAR CONTRACTION.

Sir,—The above very curious subject may be illustrated in the following manner, and I think the experiment cannot fail to be interesting to your scientific readers.



n s, *s n*, *n s*, are short pieces of iron rod in helices of copper wire covered in the usual way. The ends of these helices are cleaned and inserted into pieces of small vulcanised India-rubber tubing, *b b*, into which they fit tightly. In these tubes there is some mercury to form the galvanic connection. On making these helices part of the galvanic current, by connecting them with the battery, *c c*, the iron rods become magnetic, and the opposite poles being contiguous, attract each other, and the rods are drawn together. Of course the series may be lengthened.

Thus, we have only to suppose the particles of a muscle to be polarised (in this sense) by the nervous fluid, and we see how a contraction must immediately take place.

It has long been a favourite notion with me that an artificial muscle might be constructed by filling a long-shaped bag made of very elastic membrane with iron filings and oil, or mucilage, and suspending it to a powerful electro-magnet. On completing the galvanic current, the filings would be drawn up, and the bag being elastic would give out laterally, and would have all the appearance of a contracting muscle. The oil or mucilage among the filings is to give a *vital* character to the motion. In the same way the muscle of a recently dead animal has a tendency to assume a spherical form—*i. e. to contract* when galvanised; but the particles of which it is composed being infinitely nearer together than the iron filings, attract each other with a power proportionally greater—magnetic attraction decreasing so rapidly with distance. My original scheme was to use wet bladder or gut, but now that the vulcanising of caoutchouc is discovered, a very thin bag of this material would make a more elegant experiment.

I am, Sir, yours, &c.,

M. F.

April 23, 1849.

SMOKE RESPIRATORS.—ROBERTS'S—DEANE'S SMOKE-PROOF DRESS.

Sir,—Messrs. Robinson and Siems are truly unfortunate if they can adduce no better advocacy than that of Mr. Phillips (*ante*, page 399) in support of their claim to be considered the inventors of an improved "*smoke respirator.*"

For my part, I should be extremely sorry, even if I had the power, "to sneer them out of their property." The question, at present unsettled, is simply—have they any property? Proofs in the affirmative have not yet been given. They have exhibited *results*, it is true, but such results as fall short of what has been previously done by other parties. At the same time, although acting upon well-known principles, if they

have succeeded in improving the *apparatus*, by making it more simple, more portable, or cheaper, they are clearly entitled to credit, which I should be one of the first to acknowledge; but it should be borne in mind, to establish a case of merit upon their part, it must be something simpler, cheaper, and more portable than *a wet woollen comforter!*

Permit me to observe, in reply to Mr. Phillips, that the "theory of chemical absorption" of sulphurous and some other gases by water, is not *mine*. The fact, however, is so well and so long established, that to doubt or deny it, would bring in question the sanity of stronger minds than that of Mr. Phillips.

Mr. Phillips in his letter appears to confound the "smoke respirator" of Mr. Roberts, with the "smoke diving apparatus" of the late Mr. Deane (patented by him in 1823), which has for some time past been most successfully employed by the firemen of the London Fire Brigade, under Mr. Braidwood, and frequently noticed in your Magazine: Mr. Phillips, however, says "it has not been generally useful!" With Deane's apparatus a person may remain in the densest smoke for an indefinite period, a constant supply of fresh air being pumped in. The object of a "smoke respirator," however, is merely to enable a person to pass, and repass, or remain a few minutes in a vitiated atmosphere, and this is effected by Roberts's apparatus.

Had the question really been, as stated by Mr. Phillips, "How can we live in Smoke?" who so well qualified to furnish an elucidation as the author of the "AERODIPHRAS,"* "FIRE ANNIHILATOR,"† &c.

I remain, Sir, yours respectfully,

WM. BADDELEY.

20, Alfred-street, Islington, May 1, 1849.

REPORT UPON AN IMPROVEMENT IN STEAM BOILER FURNACES, BY HENRY F. BAKER, OF BOSTON, MASSACHUSETTS. BY THOMAS WICKSTEED, ESQ., CIVIL ENGINEER, HON. MEM. ROYAL CORNWALL POLYTECHNIC SOCIETY, ETC.

Upon the 16th ult., Mr. Amory, agent of the trustees of Baker's furnace, called upon and showed me drawings of the above furnace, and gave me a pamphlet to read which contained a general description of the furnace, and also certificates from several American engineers, testifying the great economy in fuel obtained wherever the new furnace had been introduced, and wished to have my opinion as to its superiority over the furnaces in general use.

I told him that the introduction of "the semi-elliptical chambers or retorts" (instead of straight bridges), causing "the fire" to be "reverberated upward and backward," was new to me; and that, inasmuch as it checked the draft and retained the heat for a longer period at that part of the boiler where it would produce the greatest effect, I thought a great saving might be obtained over the furnaces in ordinary use.

That in fact, by this plan, it appeared to me that with a simple cylindrical boiler of 30 or 40 feet in length, with the chimney immediately at the end of the *first* flue, the same effect would be produced as in the Cornish boilers, where the flues were carried, first, through the inside of the boiler to the farthest end, thence along the sides externally to the front, and thence back again along the under side of the boiler to the chimney; the flame or heated air having, therefore, to traverse the boiler *three* times; and that, if this were the case, the saving in *the first outlay* upon *boilers* and *buildings* would be very considerable, in addition to the annual saving in fuel.

Mr. Amory was very desirous that I should try the new furnace upon the Cornish boilers belonging to the East London Water Works Company. I suggested that as the principle of slow combustion had been carried out so much farther than usual in the furnaces at Old Ford, it would scarcely be a fair trial; because the combustion was already so slow, that while the fire-doors were open for firing, the flame and smoke came out into the stoke-hole; but that, if he was determined to have a trial made, he must not expect the saving, if any, to be at all equal to that obtained by the introduction of the new furnace into works of the ordinary construction. He, however, resolved to have the trial made; and the result has proved that a considerable saving has been effected, and that he was therefore wise in trusting to this trial.

I may here observe that the statements, published in the pamphlet referred to, showing the very great saving effected in America should not be rejected without examination, *because* they show very great and perhaps to some, almost incredible results; the question is not what *per centage* of saving has been effected, but what is the amount of the *ultimate result* obtained. If this be *greater* than experience has hitherto shown, there may be some reason for doubt; if it be not, why should the statements of saving be considered incredible? Now it appears that at three trials, made at three different works, viz., 1st, at Messrs. Heywood and Carne's establishment, in Charlestown; 2nd, at the Dry Dock, Navy-yard, at Charlestown;

* Vide, *Mechanics' Magazine*, vol. xxxix., p. 160.
† *Ibid.*, vol. xlii., p. 101.

3rd, at the Portsmouth Cotton Mills; the weight of water evaporated from 212° was *before* and *after* the introduction of the Patent Furnace respectively as follows:—

	Before.		After.				
No. 1.—	$7\frac{367}{1000}$	..	$11\frac{890}{1000}$,	showing a saving in Fuel of		61	per cent.
No. 2.—	$7\frac{558}{1000}$	..	$8\frac{788}{1000}$,	,,	,,	16	,,
No. 3.—	$6\frac{260}{1000}$	..	$8\frac{600}{1000}$,	,,	,,	35	,,

In the first two experiments the coals used were anthracite, and the mean of the two trials will show that $10\frac{336}{1000}$ lbs. of water were evaporated from a temperature of 212° by 1 lb. of anthracite coal; in my experiments, published in 1841, $10\frac{803}{1000}$ lb. of water were evaporated from a temperature of 212° by 1 lb. of anthracite coal. According to the first report of the royal commissioners "upon Coals suited to the Steam Navy," lately published by Parliament, it appears in Table No. VI., page 15, that they found that 1 lb. of anthracite coal evaporated $9\frac{46}{100}$ lbs. of water from 212°; and they further observe that a Cornish boiler may evaporate 20 per cent. more than the one used by them in their trials; if this be correct, the water evaporated would be (*see* Table X., Appendix to their Report) equal to 11·34 lbs. Now taking the average of my experiment, the Commissioners' and the Cornish, the result will give a mean of 10·331 lbs., which happens to be identical with the mean of the two American trials. As regards No. 3, the description of coal is not given: and in the account of the trial made at the Eagle Furnace, in Albany, the work done previous to the introduction of the new furnace is not given, and therefore no comparison can be made; nor should I be satisfied with the accuracy of a result obtained upon so short a trial as one of thirteen hours' duration. As the ultimate amount of evaporation, given in the three experiments quoted, is therefore not improbable, there can be no reason for rejecting those statements *because* the saving obtained is so considerable, even as much as 37 per cent. upon the average of the three trials.

Having undertaken to try the effect of the new furnace, as regarded the saving of fuel to be obtained, I have been several weeks prosecuting the inquiry, which was perhaps a longer time than might be considered necessary; but having from experience ascertained that *short* experiments are comparatively valueless, I would not undertake to give an opinion without ample time being allowed me; and when it is considered that a variation in the quality of coals from the same heap, their state of dryness, the level of the water in the boiler at the beginning and termination of an experiment, (which, in a high-pressure boiler when supplying a steam engine, is from the oscillation that takes place, very difficult to determine with accuracy,) the state of combustion of the fuel at the beginning and end of a trial, the temperature of the feed water, &c., may and does lead to the most erroneous conclusions, I think it will appear evident that but little reliance can be placed upon *short* trials, and that where there are so many points to be carefully attended to, the longer the duration of the experiments, the greater will be the accuracy obtained. The *shortness* of the trials, made *previous* to the adoption of an invention, accounts for the constant disappointments that manufacturers are exposed to, when, after expending large sums of money with the view of obtaining an advantage, they find, after a *longer* trial and further experience, they have not obtained the promised advantages. A short trial is therefore an injustice to the manufacturer, and it is equally so to the honest inventor, whose plans may thus be rejected on too slight grounds. I have made these remarks at this length, in order to satisfy the parties for whom I have been making the experiments herein reported; and, although I have been cautious in experimenting, and perhaps also slow in believing that any saving of fuel could be made by introducing their furnace into the boilers in question, nevertheless this precaution will be of advantage to them, for I think they may fairly conclude hereafter that if in some instances no benefit is derived from the introduction of their furnace, in such cases the failure may be attributed to some other cause than a defect in the invention.

The experiments were tried upon three Cornish boilers, the outer cases being 6 feet 6 inches diameter, the fire-tubes 4 feet in diameter, and the lengths being 34 feet.

The following regulations were adopted, viz.:—

The coals were weighed out every twelve hours.

The clinkers and ashes were weighed every twelve hours.

The temperature of the feed-water was taken every hour, day and night.

The water was measured by a metre into the boilers, and the counters were taken every twelve hours; the counters of the engine being taken every twelve hours also; for as the weight lifted by the engine every stroke was the same, its working formed an admirable *check* upon the other observations.

I made several experiments upon the consumption of fuel with different quantities of air admitted into the flue through the bridge, and the one recorded was the best, each opening in this case being equal to 9 square inches, or in the aggregate 27 square inches.

The two experiments recorded in detail were, first, with three boilers *without* the new furnace; and secondly, the same boilers *with* the new furnace.

The coals used were *small* Newcastle coals of *inferior* quality.

Detail of Trial and Results.

	Experiment without the New Furnaces.	Experiment with the Furnaces.
1. Duration of experiment	207 hours.	108 hours.
2. Coals consumed	64,940 lbs.	31,642 lbs.
3. Ditto, per hour	313 lbs.	293 lbs.
4. Water evaporated	449,320 lbs.	243,860 lbs.
5. Ditto, per hour	2,170 lbs.	2,256 lbs.
6. Temperature of Water before entering Boilers	95·5°	90°
7. Water evaporated per lb. of Coals from initial Temperature	$6\frac{919}{1000}$ lbs.	$7\frac{707}{1000}$ lbs.
8. Ditto from 212° (latent heat 1000°)	$7\frac{786}{1000}$ lbs.	$8\frac{640}{1000}$ lbs.
9. Clinkers made	2,597 lbs.	1,428 lbs.
10. Ditto, per hour	$12\frac{1}{2}$ lbs.	13 lbs.
11. Per centage of Clinkers to Coals used	4 per cent.	$4\frac{1}{2}$ per cent.
12. Ashes made	1,298 lbs.	731 lbs.
13. Ditto, per hour	$6\frac{1}{4}$ lbs.	$6\frac{3}{4}$ lbs.
14. Per centage of Ashes to Coals used	2 per cent.	$2\frac{1}{3}$ per cent.
15. Coals *minus* Clinkers and Ashes	61,045 lbs.	29,483 lbs.
16. Water evaporated per lb. of Coals *minus* Clinkers and Ashes from initial Temperature	$7\frac{860}{1000}$ lbs.	$8\frac{865}{1000}$ lbs.
17. Ditto, from 212°	$8\frac{817}{1000}$ lbs.	$9\frac{878}{1000}$ lbs.

A reference to the fifth line in this statement will show that the quantity of water evaporated per hour was somewhat greater *with* than *without* the furnaces; but it should be remarked that, had it been necessary to work with the dampers wide open before this invention was applied, this could not have been the case, as there is no doubt that a greater draft will be necessary where the new furnaces are applied, and in this case it became necessary to open the dampers wider.

The seventh line shows that, when taking the coals from the heap, *without* the furnaces, 1 lb. of coals evaporated $7\frac{786}{1000}$ lbs. of water from 212°, and *with* the furnaces, $8\frac{640}{1000}$ lbs. of water, or $11\frac{8}{10}$ per cent. *more* than *without*. And the seventeenth line shows, when taking the coals *minus* the *clinkers* and *ashes*, that, *without* the furnace, 1 lb. of coal evaporated $8\frac{817}{1000}$ lbs. of water from 212°, and *with* the furnaces $9\frac{878}{1000}$ lbs. of water, or $12\frac{3}{10}$ per cent. *more* than *without*.

In the experiments I tried, for the purpose of ascertaining what sized opening for admission of air would produce the best effect, I found when any of the air-holes in the bridges were *increased* rather more than one-third beyond those recorded, (27 square inches,) that the reduction in effect was $5\frac{1}{2}$ per cent. and when *reduced* rather less than one-third, the reduction in effect was $2\frac{1}{2}$ per cent. as regards economy in fuel; it would appear, therefore, that the areas recorded are about the best.

After this trial, which exhibits a saving of $11\frac{8}{10}$ per cent. of fuel in the Cornish boilers, I can have no hesitation in declaring, that the saving of 37 per cent. upon the average, stated to have been effected in the American establishments, has been effected, and that there are numberless cases in Great Britain where a similar saving might be produced.

I have thus far reported upon the advantages of the invention as an economiser of fuel, and not as a smoke-consumer or preventor; for although the smoke is undoubtedly diminished, not only on account of the reduction in the quantity of coals used, but owing to the air admitted through the bridge; yet there was not a fair opportunity of testing its merits as a smoke-consumer or preventor, on account of the arrangement of the flues of these boilers; I believe, however, that with one straight flue to the chimney, as in the American furnaces, a much greater reduction would be effected; it may perhaps be as well to remark here, that the generality of boilers and furnaces are so badly constructed, that the waste of fuel and consequent increase of smoke is enormous; in any case, therefore, where the *only* objection to using any apparatus for the

purpose of consuming or preventing smoke is the extra cost of fuel, this would be more than compensated for by an improvement in the furnaces and boilers; and if a reduction of fuel were effected by introducing slow combustion generally, I have no doubt there would be an average saving of 30 per cent. of fuel in the manufacturing establishments of this kingdom. This would cause an actual reduction of smoke in proportion to the fuel; but there is also no doubt that the reduction of black smoke evolved from the chimneys would be in a much greater proportion than the reduction in the quantity of coals, in consequence of the slow combustion.

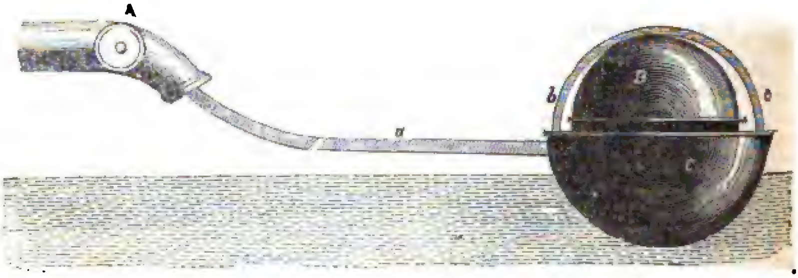
THOMAS WICKSTEED, *Engineer*.

East London Water Works.

TYLOR AND SON'S IMPROVED CUP AND BALL FOR BALL-COCKS.

[Registered under the Act for the Protection of Articles of Utility. Messrs. Tylor and Son, Warwick-lane, Newgate-street, Proprietors.]

Fig. 1.



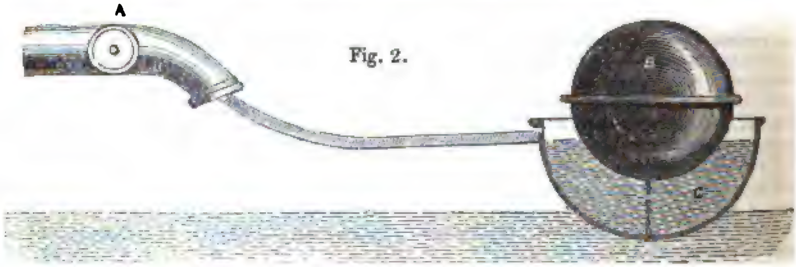


Fig. 2.

Sir,—This simple contrivance has for its object the removal of a very frequent source of annoyance to families, viz., the cutting off their accustomed supply of water through the sticking up of the ball-cock. An ordinary copper ball, weighing about three-quarters of a pound, usually possesses a floatative power of two pounds. When the plug of the cock becomes stiff, the superior rising power of the ball causes its ascent, and the cock plug being turned, the water is shut off when the cistern is filled. As water is drawn off from the cistern, however, the small gravitating power of the ball is insufficient to turn the plug, and the cock remains closed, as becomes apparent, by-and-by the cistern being found empty to the great annoyance of the family. This is a discovery, too, that is generally made on "washing day," which is not a "water day."

It might at first sight be supposed that it would only be necessary to give additional weight to the ball to obviate this difficulty; but then, the floatative power being diminished in exact proportion to the permanent weight added, must be met by the addition of more floating power also. In Messrs. Tylor and Son's improved ball-cock, the apparatus is so arranged that the desired effect is produced without the addition of any permanent load, the water itself becoming a weight *whenever its services are required.*

In the prefixed engraving, fig. 1, A is the cock; *a*, *b*, *c*, the stem or lever of the plug, which, instead of being soldered in the usual manner to the ball, B,

is attached to a cup, C, within which the ball, B, is confined.

The cistern being empty, the ball hangs down, and the service cock remains open; as soon as the water comes in, it enters the cistern, and floats the ball, B, which rises, bringing up with it the cup, C, into which, while in an inclined position, the water freely enters, but has no weight while immersed in that fluid. As the cup, C, approaches the horizontal position, it ceases to take in water; and as the ball, B, reaches the high-water mark, the cock is closed. As the water is drawn from the cistern, the ball follows it, and the water runs out of the cup; but should the plug of the cock become so stiff that the gravity of the ball is inadequate to turn it, the water recedes from it, when that contained within the cup, C, becomes a weight which ensures its descent, and effects the opening of the cock.

Fig. 2 shows another arrangement of the same apparatus, the cup, C, being shown in section, and secured to the ball, B, by a short chain. In this figure the ball is represented in the act of sticking up, until the water in the cistern has fallen so low as to give a considerable gravitating power to the cup, C, and its contents, which ensures the opening of the cock. I am, Sir, yours, &c.,

WM. BADDELEY.

29, Alfred-street, Islington, April 25, 1849.

IMPROVED ANTI-FRICTION ECCENTRIC.

Fig. 1.

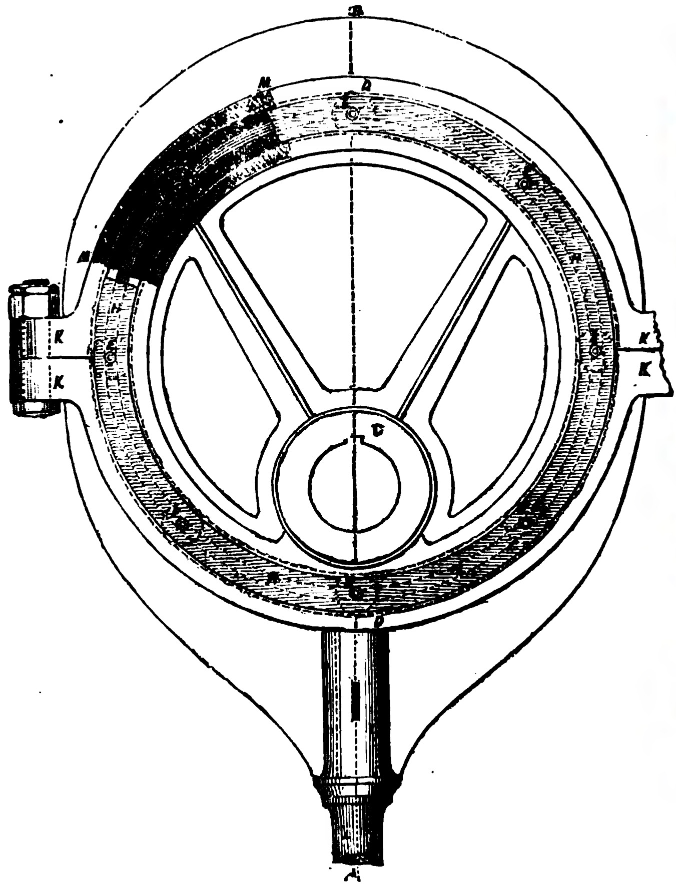


Fig. 2.

Mr. Editor,—Sir, In your Journal of April 22, and July 8, 1848, there are two anti-friction eccentrics described, one with rollers attached to the wheel, and the other with them attached to the strap. In 1847 I constructed an eccentric on the same plan, but arranged differently. The accompanying figures show the eccentric as it was executed to work two pumps, of 8 inches in diameter and 14 inches stroke. These pumps acted as air pumps, to extract uncondensed gases and liquid ether from the condenser of an engine of 25 horses power, made by me to test the merits of an invention ("to produce power by the vaporisation of ether combined with an engine made on the high-pressure principle."*) The pressure on the piston of the pump was above a ton. Under this pressure an eccentric on the common plan would have been very difficult to work, and as I had no means of introducing a cranked axle, I set about planning the one I am about to describe.

Fig. 1 is an elevation of the eccentric, with a part broken off at M M, to show the other parts beneath; and fig. 2 is a section of it on the line AB. DD, the strap or ring; C C, the eccentric wheel; EE, the rollers; GG, the axes of the rollers; HH, a thin ring on each side of the eccentric to keep the rollers at an equal distance from each other; K K, the logs of the strap, or ring D; L, the eccentric rod.

The wheel, C, and the strap, D, are both of cast iron. The rollers, E, are likewise of *hard* cast iron, they roll without noise and require no oil. All the friction is on the pins which go through the rollers, and the thin rings, H, to keep the rollers at a proper distance. If the rollers be carefully turned of the same diameter, the friction is nearly "nil." From the figures the action of the eccentric may be easily understood. The wheel and strap are turned with a ledge or rim on each side to contain the rollers. The thin ring, H H, through which the pins, G G, pass, keeps the rollers from approaching each other, and moves slowly round with the wheel. Owing to their rolling motion there can be but little wear on the ring or rollers. I am, Mr. Editor, yours truly,

Baise Lyon, March 23, 1849. WILLIAM HALL.

* The same, we believe, which is now exhibiting in London as the "Combined Gas and Vapour Engine."—ED. M. M.

MR. COTTON'S GOLD-WEIGHING MACHINE.*

[From a Statement laid by Mr. William Miller, Weighing Clerk in the Bank of England, before the Royal Mint Commission.]

When, in June 1842, a proclamation was made, setting forth that a large portion of the gold coinage in circulation had been reduced by wear below the current weight, and ordering all persons to cut or deface such sovereigns, many complaints arose, that sovereigns which were issued from one counter of the Bank were refused to be taken at another. These complaints were not only made to the Governors, but frequently found their way into the newspapers. Mr. Cotton was the Deputy-Governor at that time, and he gave the subject his earnest attention. Upon inquiry he found there was very little reason to doubt that most of these complaints were well founded.

The Bank, therefore, at a considerable expense, reweighed the whole stock of sovereigns, and took from it a large number which were sold to the Government, under the terms of the proclamation, at a loss of between 3500*l.* and 4000*l.* These sovereigns had all been weighed singly at the time they were received, and were supposed to be all of full weight; but even the second weighing did not detect all the light, as there were numerous well-founded causes of complaint of light sovereigns having been issued from the Bank counters which were proved to have come out of this select stock. It therefore became evident that the mode of weighing the sovereigns was very defective, and that some remedy must be devised. Mr. Cotton found some of the causes of the defective weighing in the rude construction of the scales then in use, and the great variation in the weights issued by the Mint; so that in a dozen new weights hardly two could be found sufficiently near to each other for practical purposes. Other errors were found to arise from the want of attention in the weigher, the natural consequence of the monotony of the employment; while the constant watching of the indicator of the scales seriously affected his eyesight.

The moisture of the air often affected the operation by causing the scales to stick to the table; and a current of air acting unequally upon the scales frequently prevented a very correct weighing when the sovereign was near the current weight. The diminution of the weight of one of the scales, by the placing and displacing of the sovereigns, rendered a frequent adjustment necessary, and was often a cause of error.

Most of the above causes of error, and

* For an account of this machine, see *Mech. Mag.*, vol. xxxix., p. 173.

many others, which it seemed at one time almost impossible to remove, were effectually obviated by Mr. Cotton's invention.

The machines were first used in January, 1844, and since then have weighed upwards of 48,000,000 of pieces, and during the whole time not a single charge of incorrect weighing has been substantiated against them. When they were first used, many complaints were made by the bankers that sovereigns which were standard in their scales were rejected by the machines and returned to them cut; but in all those cases, in reference to a very fine assay beam, it was found that the machines were correct. These complaints have, for a long time, altogether ceased; as the bankers, who send the largest quantities of sovereigns into the Bank, know well by experience that the errors of the machines, if there are any, are beyond detection by their scales, and are of so minute an amount as to be practically of no importance.

Some few sovereigns are still weighed, as they are received from the public, by the common scales; but such are never re-issued by the Bank until they have passed through the machines, which extract from them between one and two per cent. light. The Bank sustains the loss upon these unavoidable errors in preference to the loss of time, the trouble, and vexation, which the re-issues of the sovereigns as they were received would occasion both to the public and to the clerks of the Bank.

The machines require cleaning once a week, which is done in an hour by one of the mechanics in the ordinary employ of the Bank. There is very little wear in them; as the motion is very inconsiderable, and the power required to drive them only a few pounds. They weigh quite as well now as they did at first. Each machine will weigh about 33 sovereigns per minute, and the Bank has now in use six machines, five for sovereigns, and one for half-sovereigns, which have weighed 60,000 per day.

There are at present four clerks in the office; but one of them is employed in receiving the sovereigns from the public, and a great deal of the time of the others is expended in making them up into thousands, and in cutting the light sovereigns and keeping each customer's apart; so that, upon the whole, I think two persons could very well attend to the mere weighing.

I have compared the errors, above and below the remedy, in the coinage at the Mint, with the errors I have on record formerly committed by the tellers of the Bank with the common scales, and they are very much of the same character; those of the Mint being rather the worse.

In conclusion, I venture to express my opinion, that if the Mint adopted these machines, it would be easy for them to work within the legal remedy, which they certainly do not appear to do at present.

Mr. Miller, being afterwards examined, gives the following evidence :—

What is the difference in the weight of a standard and a current sovereign? — The pound troy being equal to 46*l.* 14*s.* 6*d.*, the standard weight of one sovereign is nearly 123·274 grains, and the lowest weight at which a sovereign is current by law being 122½ grains, the difference is nearly ·774 grains.

The remedy stated in the Mint Indenture being 12 grains in one pound troy, how much in decimals of a grain is this if applied equally to each sovereign?—Nearly ·257.

How much is the sovereign just within the remedy above the weight of a current sovereign?—·518 nearly.

Are the Commission to understand that when the excess of a grain is worn off the sovereign would no longer be current, and if tendered at the Bank would be clipped? —Yes.

Have you ever found a sovereign, as issued from the Mint, under the current weight? —Yes, several times; and I have sometimes sent them to the Mint. Those that I sent to the Mint were such that I was certain were issued in the state in which I found them.

Are the new coins received from the Mint usually weighed before you issue them to the public?—No. The manner in which we have detected sovereigns below the current weight has been in weighing them after they have been issued to bankers. They sometimes come in from the bankers with the Bank labels upon them, just as the Bank makes them up when received from the Mint, and it is from those sovereigns that the sovereigns below the current weight have been taken. There is a difficulty in proving that those light sovereigns were light when they were issued from the Mint, because they might have suffered from abrasion whilst they were in the bags.

Have you observed any of the coins, as received from the Mint, in other respects defective?—I have. Some of them will not ring, and some of them are imperfectly struck. I beg to produce 90, received within the last six months. These are not detected as they are received from the Mint, but when they come in from the public; for the sovereigns are not weighed singly when received from the Mint, but only when they come in from the public before they are reissued. New sovereigns are generally issued to bankers in large numbers, and therefore these coins pass unobserved. They are only

detected when they are paid away by bankers and others in small sums. Some of these are struck on one side, and some of them have a raised edge which hinders their passing through the weighing machine, and they are all in some respects visibly imperfect. There is a slit in the weighing machine, through which the sovereigns pass; and when they are thicker on one side than on the other, or have a feather edge, they will not pass into the machine to be weighed.

With the ordinary scales in use in the Bank, could the inaccuracies in the weights of the sovereigns have been easily detected?—All above the ·01 of a grain could have been detected by the common scales.

Are all the gold coins received at the Bank passed through the weighing machine?—All those received from the public are.

What inaccuracies do those machines detect in the weighings by the ordinary scales?—About 2 per cent.

How many weighing machines are now in use at the Bank, and have any of them been long at work?—There are six in use at the Bank, five for sovereigns and one for half sovereigns. One of them was at work in the beginning of 1843.

You state that since 1844, 48,000,000 of sovereigns and half sovereigns have passed through the machines, has the machine which has been so long in use weighed more than its proportion? — Yes, 2,000,000 more.

Has the beam of this machine, since it was adjusted, or the beams of any of the other machines been found worn, or to weigh inaccurately?—No, none of the beams have undergone any repair. And I may safely state that £5 would cover all the repairs arising out of accidents or wear from the commencement.

In passing the sovereigns through the machine, have you discovered that the coin itself has been worn?—No; but there is one explanation I should like to give, which is, that in ascertaining at what rate the machine is weighing, it is necessary to have sovereigns of a specific weight; and in making those experiments upon the 10,000, I weighed several sovereigns very nicely with an assay beam, and filed them down to the weights I required (I required the standard weight minus the remedy and the standard weight plus the remedy.) Those sovereigns I passed through the machine at least five hundred times, and I weighed them nicely afterwards, and I found hardly any alteration in them.

Can you state the cost of the machines *now in use* at the Bank?—1,422*l*., of which the machines cost 1,200*l*., and the necessary fittings-up the remainder—about 200*l*. a-piece.

In addition to the security of accurate weighing, can you state the saving of expense to the Bank in weighing the coins by the machine?—About 1000*l*. a-year; last year it was 1,100*l*., the first year we weighed only part, it was then 900*l*.; the next year it was 1000*l*.; and last year 1,100*l*.

On what grounds do you make that calculation?—Taking the difference between the salaries of the clerks employed in weighing by the old mode and by the new, and deducting from that difference 10 per cent. (the usual deduction from profits in machinery) as the cost of the wear and tear of the machines, and to produce the capital necessary for their replacement, the remainder may be considered as saved.

Are you of opinion that weighing machines of the same description as those employed in the Bank could be used in adjusting the weight of the pieces in the Mint?—Yes.

What does the Bank pay the weighers at the new machines, and what at the old machines?—No alteration has been made in the salaries of the clerks consequent upon their being employed at the weighing machines. Their allowance is precisely that of every other teller.

Does the management of the machine require any peculiar qualifications?—It requires great experience in the management, and requires a person with some mechanical knowledge; but this applies only to the person having charge of the machines.

PROFESSOR FARADAY.

This eminent person was the son of a humble blacksmith, who apprenticed him to a small book-binder in Blandford-street, when only nine years of age, and in which occupation he continued till he was twenty-one. The circumstances that occasioned his exchanging the work-room of the binder for the laboratory of the chemist, have been thus forcibly related. Ned Magrath, now secretary to the Athenæum, happening five-and-twenty years ago to enter the shop of Ribeau, observed one of the bucks of the paper bonnet zealously studying a book he ought to have been binding. He approached—it was a volume of the old *Britannica*, open at ELECTRICITY. He entered into talk with the greasy journeyman, and was astonished to find in him a self-taught chemist of no slender pretensions. He presented him with a set of tickets for Davy's lectures at the Royal Institution; and daily thereafter might the nondescript be seen perched, pen in hand, and his eyes starting out of his head, just over the clock opposite the chair. At last the course terminated; but Faraday's spirit had received a new impulse,

which nothing but dire necessity could have restrained; and from that he was saved by the promptitude with which, on his forwarding a modest outline of his history, with the notes he had made of these lectures, to Davy, that great and good man rushed to the rescue of kindred genius. Sir Humphrey immediately appointed him an assistant in the laboratory; and, after two or three years had passed, he found Faraday qualified to act as his secretary*

His career has been successful, and he now stands at the head of his profession. He ranks as one of the first lecturers of the day, and has published several works highly and deservedly popular.—*Arnett's Books of the Ancients.*

* *Fraser's Mag.*, xiii. 224.

ELECTRIC CLOCKS—REPLY OF MR. APPOLD TO MR. BAIN.

Sir,—I shall feel obliged if you could find room in your next Number for an answer to Mr. Bain's letter, which appeared in No. 1341, with respect to my clock receiving the electric current every vibration. Mr. Bain's assertion that it does not, *is no proof*, but only shows that he has not paid sufficient attention to the subject. If Mr. Bain will call upon me, I shall be most happy to show him that the electric current with his plan, is on, *every second*, and with my plan only *three times a minute*, reducing the number of sparks so much that the break is comparatively free from oxidation. It will also give me pleasure to explain the action of his clock to him, as it appears by his letter he is not acquainted with it. When I exhibited my improvement to Mr. Holmes, that gentleman stated that its principle and mode of action were quite distinct from any of Mr. Bain's previous plans, and overcame one of the great difficulties Mr. Bain had to contend with.

My clock goes with an earth battery, therefore, to test my improvement, I caused an extra battery to be attached to it and removed every four hours—the clock being, therefore, one four hours with the extra battery, and the next without it. My man put down what the clock was, faster or slower, every hour during the day for nearly eight months, as compared with a chronometer. When Mr. Bain's plan was adopted, the clock always gained one second every hour with the extra battery: with my plan, under the same circumstances, we could not find any difference. Therefore, we concluded it was some improvement; but as Mr. Bain is not aware of the fault, it is little use his trying to improve.

Should Mr. Bain 'improve' upon my plan as much as I have upon his, we perhaps may have a perfect clock. Then he will be bound to alter my clock, as he always promised *to improve it* when he had time. I will stay at home next Wednesday and Thursday until twelve o'clock, to show Mr. Bain, or any other gentleman, that the electric current *is connected every second with his plan*. If this time is not available, I shall be glad to make an appointment.

I am, Sir, yours, &c.,
J. GEORGE APPOLD.

23, Wilson-street, Finsbury-square.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 10TH OF MAY.

JOSEPH COOPER, Walworth, tailor. *For improvements in fastenings for wearing apparel.* Patent dated November 4, 1848.

These improvements consist in the substitution of metal studs, or projecting and slotted plates for buttons and button holes, as a means of connecting parts of wearing apparel together.

1. The trousers are fitted with two tabs in place of the front buttons, and with one tab in the centre of the back. The tabs are of a triangular form, and composed of cloth, with springs inserted between the edges, or of vulcanized India-rubber. The base of the tab is attached to the band of the trousers by sewing or otherwise, and the apex is furnished with a metal plate, fitted with a stud or projecting curved piece. The front ends of the braces are made with circular holes or horizontal slits, or are furnished with slotted metal plates, to receive the studs or projecting pieces, as the case may be. The back ends of the braces are made in one, and similarly constructed; or they may be united by a short cord passed through a metal plate fitted with holes or slots, to receive the stud or projecting piece of the tap.

2. It is proposed to attach vulcanized India-rubber, or vulcanized India-rubber webbing to the inside of the front parts of the coat, and to furnish the free ends with a projecting curved piece and corresponding slotted piece, whereby the edges of the coat may be brought and held together when required.

3. The same kind of fastenings are to be applied in the same manner to riding or walking bands, or belts, or to stays; and

4. Straps may be connected to the bottoms of trousers by having studs or projecting curved pieces attached to their ends, and metal plates with circular holes or slots in them, fastened to the bottoms of the trousers.

Claims.—1. Constructing a tab or tabs of cloth or other suitable material, with springs inserted therein, to be fixed to trousers.

2. Connecting, attaching, or fastening the brace ends of braces to trousers, by means of the connectors instead of buckles.

3. Vulcanized India-rubber or vulcanized India-rubber webbing, sewn between linen, and in combination with connectors, for occasionally fastening coat fronts together.

4. Connecting, attaching, or fastening riding or walking bands or belts and stays, and also straps to the bottoms of trousers, by means of metallic studs, eyelets, or guiding plates.

HENRY KEMPTON, Pentonville, Middlesex, gentleman. *For improvements in reflectors and apparatus for artificial light.* Patent dated November 7, 1848.

This invention, in so far as it relates to "reflectors," consists in the manufacture of reflectors of pottery or earthenware into any desired form, and coating their reflecting surfaces with what is termed silver lustre. The apparatus for artificial light is of the following varieties:—

1. An external shop lamp, which has one of these reflectors at the back, a concave glass front supported in a hinged frame, and the gas supplied to the burner by a pipe, passing down the chimney.

2. A railway signal lamp, in which the frames that support the burner and reflector are made in one.

3. A "cornucopia lamp," which has the jet horizontal, and enclosed within a glass chimney made in the shape of the cornucopia. Air is admitted at the small end of the chimney, through which passes the supply pipe. This lamp may be used with or without the reflector, as required.

4. A drop roof lamp for railway carriages, which has the reflector made fast to the roof, with a hole in the centre to allow of the passage of lamp.

5. A common street lamp, having the top constructed of one of these reflectors.

6. A gas stove, in which a parabolic or conical reflector is supported in a recess of the stove, and has a grate placed in the focus of the parabolic reflector, whereby the heat and light will be reflected into the apartment.

Claims.—1. The manufacture of reflectors by applying pottery or earthenware coated with "silver lustre."

2. Conveying the supply of gas through the chimney of the lamp, and applying a concave glass front.

3. The arrangement of railway signal lamp.

4. The arrangement of burner and apparatus, as described under the third head.

5. Constructing the tops of lamps with reflectors.

6. The arrangement of roof drop lamps for railway carriages.

7. The arrangement of apparatus and reflectors for gas or fuel stoves.

MOSES POOLE, London, gentleman. *For improvements in machinery for making nails.* (*A communication.*) Patent dated November 7, 1848.

The metal is passed between the edges of a top and bottom roller, to split it into rods of the requisite thickness, which are then passed between the edge of a second top roller and the other edge of the bottom roller, whereby they are formed into a succession of rectangular triangles. These triangular-shaped rods are then forced between a pair of vertical or horizontal matrices, to point them, and likewise a pair of cutters, to separate them, and subsequently through a punching machine, by which the heads are formed.

Claims.—1. The mode of arranging machinery for making nail-rods, by first splitting the metal, and then shaping it.

2. Making nails by means of the matrices in combination with the heading machine.

3. The application of the machine last described.

CHARLES ILES, Birmingham, machinist. *For improvements in the "manufacture of certain descriptions of dress fastenings, and in the" making up of dress fastenings and other articles for sale.* Patent dated November 4, 1848.

The patentee, who has disclaimed that portion of his title within inverted commas, so that it now reads "improvements in the making up of dress fastenings and other articles for sale," states that his invention refers to the "making up" for sale, of buttons, hooks and eyes, needles and pins, and ribbons, tapes, or other narrow woven goods, by the following modes:—

1. To make up buttons and hooks and eyes for sale, he attaches them, by cement, to cards or other surfaces. The card or other substance is fixed by registering pins to a metal box, heated by steam. Upon the card is laid a plate, perforated with small holes at regular distances apart; and gutta percha is pricked into these holes by a metal plate, furnished with projecting pieces placed at corresponding distances apart, so as to adhere to the heated card underneath. The plate is then removed, and a second one, pierced with holes of rather larger diameter

than that of the buttons, substituted for it. The buttons are then placed in the perforations of the plate, and pressed down upon the pieces of gutta percha, which retain them in position either by passing through their stitching holes or by adhesion simply.

In the case of hooks and eyes, the same process is followed, the shape of the perforations alone being varied. Or

2. The hooks and eyes may be attached to stiff card or other suitable material, by cutting it at stated and regular distances, so as to form raised surfaces, which are placed between and clasped by the bent ends of the hooks and eyes.

3. To make up pins and needles, it is proposed to employ a circular or other suitably shaped piece of paper, made with radial grooves, into which the pins or needles are placed, and a similarly shaped piece of paper is then cemented upon the top, and serves to keep them in their place. Or, they are forced into the corrugations of a piece of paper or other material by a machine, which consists of a framework supporting a pair of horizontal grooved plates. The corrugated paper is drawn by a pair of rollers between these plates, and in front of them is a third grooved plate, above which travels to and fro a forcing plate. The pins are laid in the grooves of the third plate, with their heads resting against the edge of the forcing plate; and as the corrugations of the paper are successively brought before the points of the pins, the forcing plate is made to travel forwards, and thereby drive them through the ridges of the paper.

4. The mode of making up ribbons, tapes, and other narrow woven fabrics, consists in cementing a strip of any suitable material across the edges upon one side, or in simply drawing a streak of cement across them.

Claims.—1. Making up buttons and hooks and eyes by attaching them, by cement, to cards or other materials.

2. Making up hooks and eyes by causing them to be retained in position by the raised surfaces of paper or other material.

3. Making up pins and needles by employing embossed paper and the apparatus described.

4. Making up ribbons, tapes, and other narrow woven fabrics, as described.

George Henry Bachoffner, of the Royal Polytechnic Institution, London, Doctor of Philosophy, Professor of Natural Philosophy. *For an improved means of transmitting communication or conveying intelligence.* Patent dated Nov. 4, 1848.

These improvements consist, firstly, in a mode of actuating the indicator by means of a permanent and a temporary, or electro-magnet; secondly, in a means of obtainin the step-by-step movement of the indicator; thirdly, in an arrangement for tightening the electric wires when suspended upon posts; and, fourthly, in a method of arranging letters and figures upon a dial in combination with one or more pointers.

1.—Behind the dial there is placed a permanent magnet which has suspended between its two poles one end of an electro-magnet, keyed a little above the centre, upon an axle which passes through the dial face, and carries outside the vibratory indicator. On each side of the temporary magnet are two strings (qy. springs ?) which are respectively connected with the top and bottom of the coil of the electro-magnet, and with the wires leading to the negative and positive poles of the battery; and according as the positive or negative current is transmitted to the temporary magnet, the lower end will be attracted to the opposite pole of the permanent magnet, and produce a corresponding deflection of the needle, either to the right hand or to the left. When the circuit is broken, the electro-magnet will return to its first position by reason of its gravity, but, in order to ensure this action, two weighted strings, or two springs, or pieces of any suitable elastic material, are placed on each side of the top end of the electro-magnet, and which yield to its pressure when deflected, but, on the current being suspended, they cause it to resume its original position.

2. The rotating or letter indicating apparatus, is placed beneath, and is similar to the first, with the exception that the electro-magnet suspended with one end pendant between the poles of the permanent magnet, carries a pair of pallets working into a fifty-two toothed wheel, the axle of which projects beyond the face of the dial, and carries three pointers that travel over two concentric circles, the outer one consisting of two sets of alphabets, and the inner one of a sufficient number of sets of numerals. At each vibration of the magnet, the wheel moves one half tooth round, and according to the number of vibrations, the pointers which it carries upon its axle, indicate certain letters and numerals on the face of the dial.

The bell-sounding apparatus, differs from the preceding only inasmuch as the pointer is dispensed with, and the electro-magnet carries at the pendant end a spring furnished with a hammer, which at every vibration strikes against a metal cup placed underneath. Springs are placed on each side of the spring which connects the hammer to the electro-magnet, in order to cause it to break contact with the sounding cup after the stroke.

To divert and change the current from

one apparatus to the other, the patentee employs two circles, each containing six pieces of metal, with pieces of some non-conducting substance interposed between them. The opposite pieces of metal are connected together in pairs by wires, which communicate by an arrangement of wires and set screws, with the different signalizing instruments and with one of a pair of keys, which are each furnished underneath with two points, dipping into two cups full of mercury that communicate with the positive or negative pole of the battery. Above each of the circles are eliptical springs, which may be moved freely round, so as to bring the pair of metal pieces into communication, according as it is wished to operate upon one or the other of the signalizing apparatus; and the vibration of the needle, which results from the passage of the electric current, may be either to the right or to the left, according to which one of the keys is depressed, inasmuch as they transmit the current in opposite directions, and thereby change the polarity of the pendant end of the electro-magnet, and consequently cause it to be attracted by the north or south pole of the permanent magnet.

3. In order to tighten the conveying wires, it is proposed to make some one or other of the supporting posts in the series, with the top, on which the wires are suspended, so that they may be depressed or elevated by means of a rack and pinion. Also, to cover the top of the post with a cap of glass or other material, to shield it from wet.

4. The mode of placing the letters and figures on the dial would not be intelligible without drawings. We may, however, state that the principal features appear to be an arrangement by which the letters the most frequently used will require the least number of vibrations to indicate them; and the printing a number of messages in radial lines upon the dial face, to be indicated by another pointer. In the case of using more than one vibratory pointer, a corresponding number of keys and apparatus would be required for each.

Claims.—1. The improved means of transmitting intelligence by means of a temporary or electro-magnet vibrating between the poles of a permanent magnet, whether in a horizontal or vertical plane.

2. By an electro-magnet vibrating between the poles of a permanent magnet, which gives motion to a rotary indicator.

3. By the conveying wires, kept in tension and position by having the points of suspension elevated or depressed, as required.

4. By the arrangement of letters and figures on a dial plate, in combination with one or more pointers.

Specifications due, but not enrolled.

James Napier, Swansea, operative chemist. *For improvements in the manufacture of copper and other metals and alloys of metals.* Patent dated November 9, 1848.

Richard Coad, Kennington, Surrey, chemist. *For improvements in the construction of blast and other furnaces and fire-places.* Patent dated November 9, 1848.

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal.*]

For an Improvement in Boot Crimps. *Cosman White.*

The patentee says,—This invention consists in connecting the jaws to the end of the lever for operating the same, by two slightly inclined bars, for connecting rods, attached at their upper ends to the jaws, and at their lower ends to the lever, by pins or bolts, having oblong slots formed in them, through which is passed a horizontal bolt, which is also passed through the end of a curved bar or dog, extending downwards between the inclined bars, and through two oblong metallic plates, pressed against the outsides of the slotted bars by a head and thumb, or hand nut, at the extremities of the bolt, in such a manner as that, when motion is given to the lever, and the upper edges of the jaws commence to crimp the leather, the upper end of the curved bar or dog will strike the lower edge of a curved form or bar forming part of the frame, and arrest the progress of the bolt and plates, while the jaws will be allowed to proceed, and be forced over the boot leather, and being kept the same distance from the crimp by the plates and bolt, will exert the same degree of pressure at every point. *Secondly,* In connecting the extremities of the jaws together, by projections or cogs cast on the inner sides of one jaw, and extending through vertical slots in the frame, into mortices formed in the extremities of the jaw on the opposite side; thus not only performing the office of guides for the jaws, during their up-and-down movement, but also connecting the two together. Likewise in casting a guide arm on the cogged jaw, for moving up and down in one of the mortises in the frame for guiding the jaws, during the operation of crimping.

Claim.—*First,* The method of preserving the parallelism of the inner sides of the jaws with the outer sides of the tapered crimp board, during the operation of raising and lowering the jaws for crimping the upper, by which a uniform and equal pressure is produced upon the leather by means of the aforesaid combination and arrange-

ment of the dog, screw, and plates, with the slotted bars and curved jaws, operating in the manner and for the purpose set forth, the said dog being free to play up and down loosely between the form and base of the frame.

Secondly, Interlocking the ends of the jaws by means of the cogs and mortises, in combination with the oblong mortises in the frame, in which the cogs rise and fall during the operation of the jaws, as described.

Thirdly, The manner of connecting the shutter to the plates, by means of the socket joint, as described.

Fourthly, Making the frame with a curved form the shape of the lower edge of the crimp board, upon which the leather to be crimped is first placed, preparatory to its being pressed over the crimp board.

FOR AN IMPROVEMENT IN HOT WATER APPARATUS FOR HEATING BUILDINGS. *Anthony E. Hitchings.*

This improvement consists in providing a series of double cylinders, connected together first at top and then at bottom, and both ends of the series with a boiler, so that the water heated in the boiler shall ascend in the space between the two first cylinders, down between the second set, then up between the third set, and so on to the end, and then delivered to the boiler, the circulating force given to the boiler by heat being sufficient to enable it to ascend and descend more than once;—each set of double pipes or cylinders is thus constituted a heater, that radiates heat from the two surfaces; instead of making these round, they may be of any other form. To prevent accident from overheating of the water, and to keep it at its proper level, a ball cock and waste pipe is applied to the reservoir.

Claim.—The plan of radiating heat by hot water, which circulates from a boiler and back to it, and in its circuit passes up and down two or more times through a series of heaters, each consisting of two tubes, one within the other, the water passing between the two, that the outer and inner surfaces of the heaters may radiate heat, and these being so combined as to receive the water from the boiler at one end of the series, while the other end gives it out to the boiler, and the series of heaters being so connected as to require the water to ascend, descend the second, ascend in the third, and so on through the series, by the connection of the two ends of the series with the boiler.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Newton, of Chancery-lane, civil engineer, for improvements in the Jacquard machine. (Being a communication.) May 5; six months.

George Edmond Donisthorpe and John Whitehead, of Leeds, manufacturers, for improvements in preparing, combing, and heckling fibrous matters. May 8; six months.

Samuel Wilkes, of Wednesbury Heath, Wolverhampton, brass founder, for improvements in the manufacture of knobs, handles, and spindles for the same for doors and other purposes, and improvements in locks. May 8; six months.

Robert Sutcliffe, of Idle, near Bradford, York. cotton spinner, for improvements in machinery for spinning cotton, silk, and other fibrous substances, May 8; six months.

George Henry Dodge, of Manchester, manufacturer, for certain improvements in machinery for spinning and doubling cotton yarn and other fibrous materials, and in machinery or apparatus for winding, reeling, balling, and spooling such substances when spun. May 10; six months.

LIST OF PATENTS GRANTED FOR IRELAND FROM THE 20TH OF MARCH, TO THE 20TH OF APRIL, 1849.

John Harris, of No. 4, Richard's-terrace, Albion-street, Rotherhithe, Surrey, engineer, for a mode or modes of founding type, and of casting in metal, plaster, and certain other materials. March 24; six months.

Walter Richards, of Edinburgh, Scotland, type founder, for improvements in casting printing types, and other similar raised surfaces, and also in casting quadrats and spaces. April 3; six months.

James Henry Staple Wildsmith, City-road, experimental chemist, for improvements in the purification of naphtha (likewise called wood-spirit, and hydrated oxide of methyle,) pyroligneous acid, and cupion, and certain other products of the destructive distillation of wood, peat, and certain other vegetable matters; and of acetate of lime and shale; and in the purification of coal, tar, and mineral naphtha; likewise spirit, being the product of fermentation. April 3; six months.

Stephen White, of Victoria-place, Bury, New-road, Manchester, Lancaster, gas engineer, for improvements in the manufacture of gases, and in the application thereof to the purposes of heating and consuming smoke, also improvements in furnaces for economising heat, and in apparatus for the consumption of gases. April 19; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subject of Design.
May 4	1877	William and Henry Hutchinson	Sheffield	Dilator for syringe.
5	1878	M. P. P. Bourjeaurd	Davis-street, surgeon	Elastic pessary.
8	1879	Edward Simons	Birmingham	Fastening for trouser straps and other articles of dress.

Advertisements.

NOTICES TO CORRESPONDENTS.

To Correspondents.—*The notice of Mr. Bright's Improvements in Lamps is unavoidably deferred till next week.—B. R., declined.*

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1345.] SATURDAY, MAY 19, 1849. [Price 3*d*, Stamped, 4*d*.
Edited by J. C. Robertson, 166, Fleet-street.

LOCOMOTIVE CARRIAGE, ON A NEW PRINCIPLE, FOR COMMON ROADS.

Fig. 1.

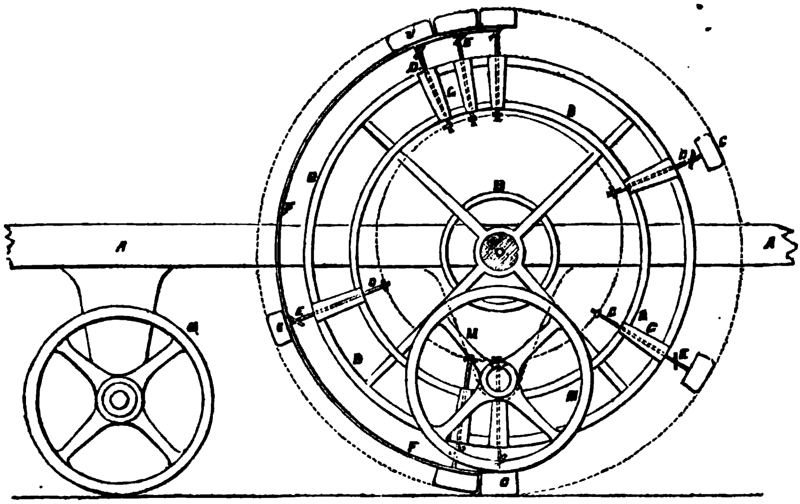
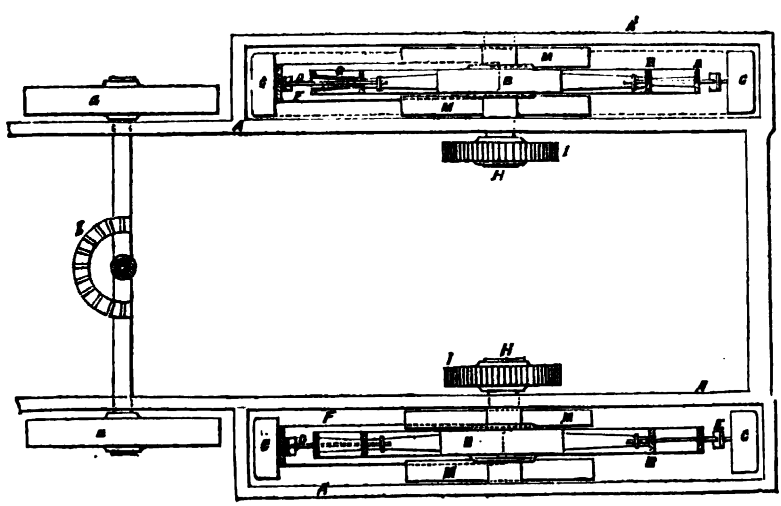


Fig. 2.



DESCRIPTION OF A LOCOMOTIVE CARRIAGE, ON A NEW PRINCIPLE, FOR COMMON ROADS.

[COMMUNICATED BY THE INVENTOR.]

Sir,—I beg to submit to you for such notice as you may think fit to give in your Magazine, a narrative of experiment and observation on the principle of a locomotive machine patented by me in 1845, and which has since been waiting its turn for public patronage. It is for common roads, and although railways have, to a great extent, in this country, superseded such inventions, and although many abortive attempts *in my line* have been made, I have full confidence in my invention, which has many quite original points.

Twenty years ago I modelled a machine (in miniature) on the same principle (Mr. Toplis, engineer, and others saw and approved of it,) except that the pressure was communicated to the lever by a bar near the axle instead of by a part of the machine (wheels) close to the fulcrum and the ground. The gear also for working the levers which then had a vibratory or reciprocal and not a circular action was too complex. I did not resume the subject until 1845.

The same machinery acts very well as a paddle. I applied it to a punt of two tons (1846) with a little different adaptation of the surface which communicates pressure to the fulcrum, and I had a feathering paddle, which came out of water quite unloaded with water. The paddle worked in a hole cut through the bottom of the punt.

I think therefore the invention may suit the East India Company, and I have written to them accordingly.

It is my intention to test the machinery under steam as soon as I find an opportunity. But several months of close confinement from a disabling sickness and health still unsettled, will cause me much delay. In the mean time, as this invention has at present no friend but its natural protector, the inventor, I have thought it due to the public service, as well as a means of easing myself of responsibilities, now to call the attention of scientific men to the machinery in question.

I am, Sir, yours faithfully,

G. B.

March 30, 1849.

Narrative, &c.

In April and June, 1845, after similar experiments in February and March of the same year (when the surface was at one time snow, and at another soft mud after a thaw,) a machine in model worked by hand, drawing a load of twice its own weight, ascended an incline of 1 in 8, being the road from the "Dysart Arms," Petersham, to the "Star and Garter," Richmond Hill. The impelling levers on these, as on the earlier trials, made impressions as clean as type under the press—not dragging nor hanging on the path. The progress was stopped and resumed at pleasure without any extra effort on a new start. To prove the working or wearing capacity, the machine was allowed to descend the same incline, attaining a speed of 100 turns of the axle per minute, and making a curve of a few yards diameter (the turn into the Kingston-road) without jarring any part of the machinery, or the hand at the guide wheel.

The principal parts of the same machine are still in working order, after experiments continued through four years.

Without pretending to the simplicity or capacity for speed of the "driving wheel" (the simplest impelling leverage) and leaving that as a necessary adjunct to the railway, or as the only means of working out the velocity attainable and sustainable on a level, the present invention founds its efficiency on the ground of its working up and down steep inclines, or in being a "locomotive" *without* a railway.

The proof by experiment as to the capacity of bite, or holding in this machine, ought to be allowed due weight; but it has been met by dicta of high authorities, that the "driving wheel" has a bite on the path as intense as that of a lever holding by "sliding friction," or as the wheel would hold if locked.

Such an opinion has sometimes been defended by arguments as—1st, That a wheel and a succession of levers might touch the path in the same number of points, and under the same pressure, should have the same bite; or, 2nd, That the wheel holds as a toothed wheel, and that the teeth, or points of contact, have all the *bite* the pressure can give. Other

objections are offered as to the wear of any levers or fulcra taking the ground except by a continuous periphery. But the above experiment proved that there is no concussion when the contact takes place.

The wheel or roller may appear to be a system of concentric and equal props sustaining a heavy body over the roughness of the road. But the wheel is only reduced to a prop when locked. In "rolling," or "wheeling," there is

Fig. 3.

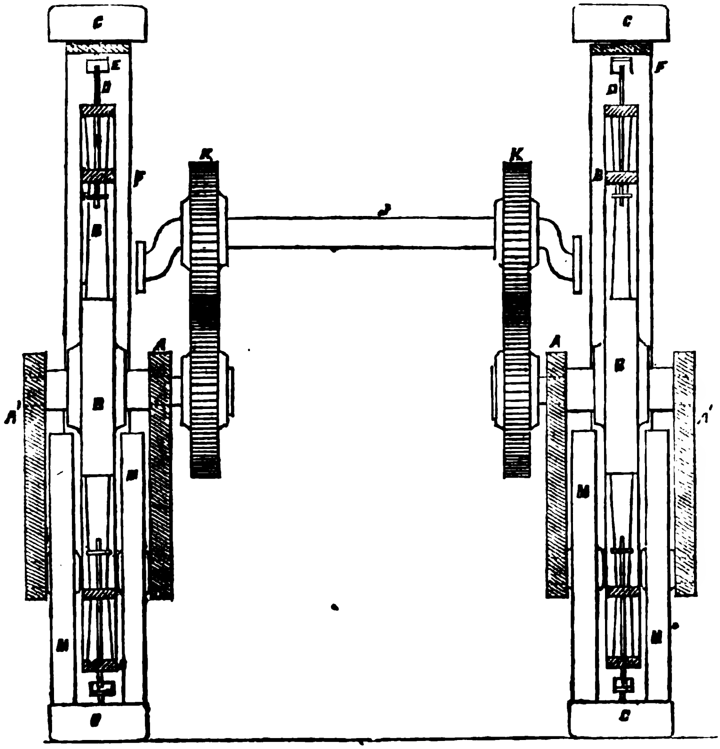


Fig. 4.

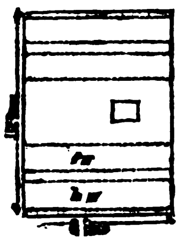


Fig. 5.

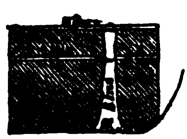
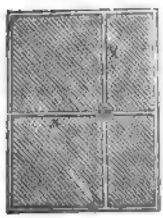


Fig. 6.



a succession of props without any resting point or fulcrum: "sliding friction" or a fulcrum due to pressure is measured by the force with which, or the degree of decline of plane by which the fulcrum is upset, or the body is made to lose hold of its path and slide from a resting point; the force or incline to

convert a rolling forwards to a backward roll, is the co-relative of the bite of a wheel or roller.

A polygon of an infinite number of sides would not *roll;* a wheel resting at points infinitely near would fall over on successive bases like a polygon. The contact of the periphery and road is not tangential, as there is no rolling between surfaces perfectly hard and smooth; there seems to be actual inter-penetration; congealed fluids and surfaces reduced to the smoothness of fluids by oil, &c., are not available for rolling. The sinking of a wheel below the surface, gains no bite, for rolling, from the sides clinging to the edges of the groove. Teeth or prominences on the convex surface of the wheel resist, and do not promote rolling. The parts or points of a periphery which are the means of rolling, do not roll over each other, as in the case of toothed weels, because at each point of contact, in rolling over each other, they would be under the whole pressure that gives bite, and lockage would ensue, or the parts on bite would be broken off.

At extreme velocities in railway trains the resistance approaches that of sliding friction. It may be, that the points or parts in bite hold by other points on their surface, as by the sides which would upset the *rolling-bite;* or the parts on bite are broken down, and the wheel falls over on infinitesimal bases as a polygon.

But without hypothesis, experiments prove that "rotary friction," or the *bite* of wheels, is less than sliding friction; railway maxima of velocity form the exception.

Comparative Advantages of Wheels and other impelling Levers.

The wheel is a component part of every land carriage; is the simplest form of lever (for succession); is driven by connecting the power with any point on the disc of the wheel.

The wheel has the disadvantage of slight *bite* on the path; it lifts the axle over obstacles, while the connecting rod of the power or handle on the wheel makes no compensatory movement; so that where *springs* are used they are broken by the contrary flexure.

Other impelling leverage may hold by all the sliding friction due to the weight over the fulcrum of the lever. The axle of the levers may be separate and distinct from that of the sustaining wheels and avoid the lift which they communicate to the spring.

The turning of the working axle cannot be by a simple winch or crank movement, as in the case of the wheel, because the leverage for turning is at a great mechanical disadvantage, except when the fulcrum, centre of weight or axle of levers and point of connection with the power, are brought into a straight line.

The apparent objection to impelling levers, not having a continuous periphery, viz., that their extremities or fulcra will suffer concussion on reaching their path, was met by the experiment referred to at the commencement of this paper; but it is observable, that levers without being attached to a periphery may satisfy the condition of a circle by being all of equal length at the point where they meet the path as the tangent of their circle. The shock on each lever coming into bite, may then be to that of a wheel in proportion to their bite. At high (railway) velocities the shock from the centrifugal action of the wheel coming into bite is of increased intensity. A regulated velocity will reduce the shock of impelling levers to that of wheels at higher velocities; perhaps fifteen miles an hour will be the maximum speed for other impelling leverage than the wheel.

By the evidence of Sir J. McNeil, H.C., 1836, the relative wear of wheel tire and of the shoe of the team of a "fast coach," was as 1 : 3. According to these data one-third of the velocity of the "driving wheel" would be, or exceed, the maximum recommendable for other impelling leverage.

Description of the Experimental Carriage.

Fig. 1 is a side elevation of one half of the carriage (viewed from the inside), but including, for the sake of clearness, a few only of the levers (D D) and their immediate appendages.

Fig. 2 is a horizontal plan of the entire carriage taken through the centre.

Fig. 3 a vertical section through the axis of the levers (D).

A A is the body frame of the carriage, to which there are attached two supplementary frames, A^1 A^1, one on each side, of about two-thirds the length of the main body.

a a is a pair of small fore wheels which

are connected by a common axis, *c*, and are used in this case merely to guide the carriage; being controlled by a tiller which turns a toothed wheel, *b*, which takes into a rack on the axis, *c*.

B B are the two substitutes for the ordinary driving wheels, which work respectively within the supplementary side frames, A^1 A^1, and are mounted independently of each other on short axes, H H, passed through the sides of the main frame work, A A.

Each of these pieces, B B, consists of three rings connected together by radial arms, and of a circle of sliding levers, D D, to the outer extremities of which friction blocks, C C, are hinged, and which levers work to and fro through stuffing or grease-boxes, G G, inserted between the two outermost of the three rings.

E E are guide pins which are passed obliquely through the levers, D D, at a little distance behind the friction blocks, C C. On the lever frames, B B, being made to rotate (by the means to be presently explained) the levers, D D, are of course successively projected outwards, each to the full extent allowed by its stuffing-box; but almost immediately after passing the perpendicular line, the oblique guide pins, E E, catch against the inside of an eccentric piece, F, attached to the main-body frame, A A, which causes the levers to recede inwards again, and the blocks, C C, to follow the course of the eccentric piece, F (but outside of it) till they reach their lowest point of depression, which is that where they first come into contact with the ground. As the blocks escape from behind the eccentric piece, F, they come under the bite of two parallel pressure wheels, M M, which are supported by bearings thrown out from the main body frame of the carriage, and the axes of which are on a line with the axis of the lever frame, B.

The eccentric frame, F, differs only *one* per *cent.* from the circle of revolution of the levers, D D, when out at their greatest extension.

A top plan of one of the friction blocks, C C, is given separately in fig. 4; and a vertical section of the same in fig. 5. On each side of the part where the lever, D, is inserted, there is a clear way of 5 inches for the track of the pressure wheels, M M, which, supposing them to be 1½ inch in width, will allow of 2 inches for the respective axle boxes. *x w*, are iron bands or clasps for supporting the socket of the lever. From the centre of the socket the block has 5 inches radius so as to clear the ground on turning on its hinge into position. A plan or horizontal section through the socket of the lever is given in fig. 5.

The rotation of the lever frames, B B, and thereby of the entire carriage, is proposed to be derived from a light steam engine placed on the back part of the framework, and working a crank shaft, J (see fig. 2), on which there are two toothed wheels, which take into two pinions, I I, affixed to the inner ends of the short axes of the frames, B B.

On very smooth common roads, or on tramways and railways, one pressure wheel, M, might very probably be found to suffice.

But, on the other hand, should the road be rough, and obstacles have to be frequently surmounted exceeding one inch in height, it would most likely be found necessary to employ, not only two pressure wheels, M, but also a second pair of lever frames; for a block, when it has to surmount any considerable obstacle, acts at a great disadvantage without the aid of levers having some independent fulcra, like the hind foot of an animal stepping.

The length of slide of the levers is equal to the versed sine of the arc or angle of the stride or step of each lever, or of the arc described by the frame during the hold of each lever on the ground; being, in the case of an 8 feet wheel with 36 levers, an arc of 15°. The oil or stuffing boxes need not exceed an inch in length for a wheel or circle of 8 feet diameter having 36 levers: the length of the boxes increasing as a less number of levers is used.

The slide of the levers might be well enough effected without the oil boxes, but with them, judging from similar working machinery, there would be no sensible wear of the levers in, perhaps, ten years. The sliding might take place on the blocks or fulcra, but it is not advisable to increase their weight by the necessary addition of sliding boxes; and moreover, the rising and falling of the hinge would interfere with clearing the ground on the blocks turning into bite. In the model, the levers are square (inch) bars, sliding in holes cut in their circular frames.

Postcript.

By way of apology for obtruding on the public a locomotive machine, differing so much from their old and established favourite—"the driving-wheel"—I may observe, 1st. That this machine, in a sufficiently heavy model, works well; and 2nd. That the wheel itself, even on a level railway, does not work correctly; that the engine seldom comes in but with screws loose; will not work a twelvemonth without repairs, and (after repairs) is out of work or use in ten years.

In my experiments I have tried simpler gear than I use, to the extent of breaking some parts under trial (results anticipated on calculation); and I can say, that a simple handle or crank on the axle, turning it all round, is constantly tending to produce torsion: by substituting for rolling action a fulcrum that holds and rests on its hold, this torsion immediately becomes active, and the axle or its handle are quickly broken. To give full proof:—In one instance, ascending the Richmond Hill, I allowed a handle on the axle to be bent and partly broken by the torsion incurred in working the axle by it *all round*. I then had the same handle worked, not at all in the under turn, but only through a small arc above the axle. The handle did not break further, and we completed the ascent. Again; in fitting the axles with toothed wheels, these were in contact by (say) three teeth, making an opposite vertical angle, or arc less than the stride of the levers that were pressed on the path: the power would not act until I had reduced the stride of the levers to an arc or angle corresponding to that of the teeth in contact.

My machinery has never incurred derangement, except in experiments purposely made *against* the principle of its working; and although the blocks or fulcra will require periodical re-shoeing, the revolving frame, the axles and gear, as well as the levers, would stand, I think, ten years' wear, while the engine would incur none of the present derangement from the crank action on the axle, and from the increased resistance and disordered rolling friction at extreme velocities. I think the engine would double its existence. In a word, there is no active nor latent torsion *here;* and for shocks and lifts over a rough path, provision is made, and these forces act only or chiefly on the carriage and its springs.

ON ZERO SYMBOLS.

Sir,—I take the liberty of handing to you for publication the accompanying letter which I have just received.

To J. Cockle, Esq., M.A., &c.

Sir,—It was only last week that I received a copy of Number 1340 of the *Mechanics' Magazine*, which I find contains a letter from Professor Young relative to your paper on "Algebraic Symbols," published in No. 1338. I have read his letter attentively and with much interest.

The Professor's acumen in mathematical research, his profound acquaintance with the most difficult and abstruse departments of the analytic art, and his well known and admitted abilities as a cultivator of science in general, unite in demanding, from me at least, the utmost deference to his opinions on scientific questions; and, therefore, while I express my dissent from him on the question at issue, I would endeavour to do so in the most diffident and respectful terms.

In the second paragraph of the Professor's letter, as well as in the first paragraph of the addendum to that letter, the point for which I have contended is, I think, virtually conceded. It is admitted that $+0=-0$ when the two members of the equation are viewed simply as results. Does it not therefore follow that if by the substitution of any number for x, in a proposed equation, this result is obtained, the number so substituted is a root of that equation? This only is the question disputed; and the fact of these results having "totally different origins" appears to me in no way to affect this question.

The remarkably concise manner in which the Professor stated his objection to my method of deducing equation (2) from (1), on page 293, is, perhaps, the reason why I do not feel the force of that objection. May I be permitted to trouble you with the following modification of my argument.

$$\text{Since } a-a=\pm 0 \ldots\ldots (\alpha)$$

$$\therefore\ 2a-2a=\pm 2\cdot 0 \ldots (\beta)$$

$$(\alpha)-(\beta) \text{ gives}, -a+a=\mp 0 \ldots\ldots (\gamma),$$

comparing (α) with (γ), $\pm 0=\mp 0$, $\therefore +0=-0$.

Now, it will be observed, that the zeros in (α) and (β) are identical, and, consequently, are in the ratio of equality. I cannot see, therefore, how any valid objection can be taken against the preceding process for the deduction of (γ) from (α) and (β).

I am quite aware of the importance of discriminating carefully between zeros that *are* and zeros that *are not* in the ratio of equa-

lity. The Professor, however, seems to have overlooked the fact, that, in my second letter, when I propose to take $2\frac{1}{2}\cdot 0$ from both sides of the equation $3\cdot 0 = 2\cdot 0$, I am only pursuing the line of argument which he himself adopts in his paper on "Congeneric Surd Equations;" (*Mechanics' Magazine*, vol. xlix., pp. 463—4;) and that my intention in doing so is to show that "the same reason which he assigns, for the inadmissibility of the condition $+0 = -0$, applies with equal force to the condition $3\cdot 0 = 2\cdot 0$, and therefore, that if the root which substituted gives the former result must be rejected, the latter must be rejected for the same reason." Now, I doubt not, you have already observed that in the paper to which I have just referred, the *infinities* are treated as if they were in the ratio of equality; whereas, their ratio is, in reality, that of $1 : -1$. If, therefore, because $+0 = -0$, we may legitimately conclude that $+\infty = -\infty$, it by no means necessarily follows that $2\infty = 0$; for, since transposition, in this instance, is simply the addition of ∞ to both members of the equation, to arrive at the final result, ($2\infty = 0$,) we must grant the "contradictory hypothesis" that the infinities *are*, and yet *are not* in an equal ratio. This hypothesis, however, obviously cannot be granted, and therefore I still contend that the Professor's argument is incorrect.

Respecting the distinction which I have made between "actual zero" and "a quantity less than any assignable number"—a distinction, by the way, not unfrequently made by Cambridge mathematical writers of undoubted ability—I have only to say that I have found it much less *perplexing* to explain the difficulties connected with such distinction to "sagacious and persevering learners," (I hope the Professor will pardon the free use I make of his expressions,) than to explain how *an infinite number of nothings actually amount to something!* This, if I am not greatly mistaken, is not an imaginary difficulty, but a real one necessarily consequent on the admission that, *a finite number divided by absolutely nothing is equal to infinity.*

If the Professor will kindly accept my warmest assurances of respect and admiration I shall feel myself honoured; and if you, Sir, will kindly tender those assurances to him, another will be added to the long list of favours already bestowed on,

Your obliged obedient servant,

ROBERT HARLEY.

Blackburn, May 9, 1849.

[*A short postscript is omitted as unimportant.*]

It will, perhaps, be convenient that the following extract from a letter which I received from Belfast a month previously should appear at the same time:

Professor J. R. Young, to Mr. Cockle.

(Date, Belfast, April 9, 1849.)

. . . .

I think that Mr. Harley should not have put the + before the 0 in his expression "$a - a = +0$" (p. 293). In strictness—and strictness here is all important—0 has claim to no sign at all. If + be assumed *continuity* is implied:—the remainder was once a *quantity* that has vanished positively: nothing but interchanging the two a's can make it negative, and such an interchange is not inconsistent with the original, any more than $a - b = -q$ is inconsistent with $b - a = +q$.

I am glad that in *your* expression "$a - a$" * * * that you have said nothing about the *sign* of the zero. In fact, as soon as you assume a sign you assume continuity and make explicit reference to a former state. Indeed I would say of isolated zero, that we are not at liberty even to write ± 0; the zero is not only *valueless* but *sign-less*—if I may coin a word.

. . . .

And this may be the proper place for the following extract from a note of

Professor J. R. Young, to Mr. Cockle.

(Date, Belfast, Feb. 13, 1849.)

. . . .

I come to this conclusion from considering that $5 - x$ under the radical, for the value $x = 5$, must be taken $+0$, otherwise, since the irrational expression would then be unreal, viz., $\sqrt{-0}$, there would be an incongruity between it and the second member, whichever sign we prefix: but if $5 - x$ be positive, then $2(x - 5)$ must be *negative*: hence the sign of the radical, to be consistent, must be negative also, therefore, with this sign, *both* roots are admissible.

. . . .

But even admitting for a moment the last objection—of which the philosophic subtlety is characteristic of my gifted friend—an equally formidable one remains behind, viz.: that under *any* circumstances we must sustain the equation

$$3\sqrt{0} = 2\cdot 0 \ldots\ldots (a.)$$

in which equation the zeros are identical, each resulting from the relations

$$5 - x = 5 - 5 = 0.$$

The above condition ought, as I have before remarked, (*supra*, p. 293) to have taken the place of the condition $3\cdot 0 = 2\cdot 0$ throughout the present discussion, and I would again invite attention to it.

In Professor Young's Algebra, 4th edition, p. 130, NOTE, ought not the word *divisor* to be substituted for "*root*"?

I am, Sir, yours, &c.

JAMES COCKLE.

2, Church-yard Court, Temple, May 10, 1849.

BRIGHT'S PATENT IMPROVEMENTS IN LAMPS.

We now proceed to give the details of those branches of Mr. Bright's improvements which we pointed out (*ante* p. 429,) as being of the most importance; namely, his mode of steadying the glass chimneys of lamps, his stiffened hollow wicks, and wicks of two altitudes. As the figures explanatory of the first, however, are equally illustrative of a fourth improvement relating to the means of raising the wick, we shall give Mr. Bright's description of both.

1. *Lamp with Improved Wick Elevator and Chimney Supports.*

Fig. 1 is a sectional elevation of a lamp; fig. 2, a cross-section on the line *a b* of fig. 1; and fig. 3, another sectional elevation on the line *c d* of fig. 2. A is the outer case of the burner; B, the internal, or air-tube. C C, the pipes by which oil is conveyed from the reservoir to the interior of the burner. D is the wick-holder, which is nearly similar to the wick-holders of common lamps. It consists of a tube which closely encircles the air-tube, and has at bottom a projecting flange, which exactly fills up the space between the wick-holder and the interior circumference of the outer case, A. The wick is slipped over the tube and held fast by two (or more) springs, *e e*, which rise up outside of the wick from the bottom flange of the wick-holder. F F, is an endless chain by which the wick-holder is raised and lowered, and which, with its immediate appendages, is inclosed in a box or case, G, formed on one side of the outer tube, A. The chain is attached by a pin to the bottom flange of the wick-holder, and passes at top over a grooved pulley, K. H, is a toothed pinion, the teeth of which gear into the links of the chain. G^2, is the spindle or axis of the pinion, H, which spindle is provided with a stuffing-box, L, and terminates in a thumb-piece, T. The stuffing-box, L, is formed in two pieces, 1 and 2, the outermost of which (1) screws upon the other (2). The spindle has a spigot formed on its inner end (next the pinion, H), which fits closely into the interior of the piece 2, and is backed up by an iron or steel washer, *x*. At the opposite end the spindle works through another iron or steel washer, *w*; and in the space between the two washers there is a spiral spring, S^1, curled round the spindle, which assists to keep the parts in a state of exact adjustment. As the spindle, G^2, is turned by the thumb-piece, T, one way or other, the wick-holder, with the wick, is either raised or lowered accordingly.

The spindle, G^2, together with its stuffing-box, L, and other appendages, is given (partly in section) in fig. 3. The endless chain may be of either of the forms represented in figs. 4, 4^a, and 4^b, or of any other suitable form.

In lamps where common oil is used, it is found preferable to employ much taller chimneys than when the finer kinds of oils are burnt; but such tall chimneys are open to the objection of being commonly very liable to lose their perpendicularity, and to shake in their bearings. The improved means which I employ to steady the glass are represented in figs. 1 and 2, and partly before described. M is the gallery glass-holder, an external elevation and plan of which are given separately in figs. 6 and 7. M^1 is the outer ring of the gallery, and M^2 an inner ring, which, however, extends only three-quarters round (one quarter being cut away to make room for the case, G, before described), and closely encircles the three-quarter piece of solid tubing, which extends about half as high as the middle of the outer case, A, of the burner. N, N, N, N, are four vertical springs (the number may be more or less, according to the size of the lamp), which are inserted and held fast between the inner ring, M^2, of the gallery and the three-quarter tubular piece, M^3. At top these springs are bent over and downwards in the manner shown. N^1, N^1, N^1, N^1, are four caps, which project from the top rim of the three-quarter tubular piece, M^3 (being cast in one with it) over the tops of the springs, N, N, N, N, and serve to guide the glass chimney when it is dropped down over the springs, so as to exclude any possibility of its slipping between the springs and the piece, M^3. The tops or free ends of the springs occupy points in a circle just a slight degree larger than the internal diameter of the chimney, and therefore, by their outward pressure, they keep the glass securely in its place, to whatever vibratory influence it may be exposed.

2. *The Stiffened Hollow Cylindrical Wicks and Wicks of two Altitudes.*

At present, all hollow wicks, though originally woven circularly, are afterwards flattened for sale, and when required to be used the change of shape they have undergone, and the softness of their texture, make it

difficult and troublesome to fix them to their places in lamps. To remedy this defect, I proceed as follows :—

I first form a string or strand of cotton, by placing side by side a number of threads of twisted cotton, say twenty (which number

Fig. 3.

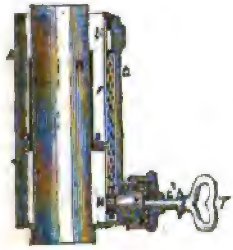


Fig. 2.

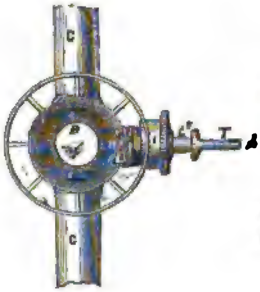


Fig. 1.

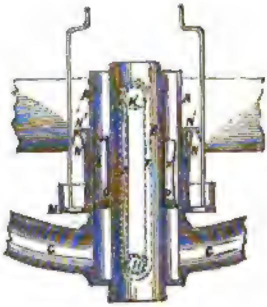


Fig. 4.

Fig. 4ª.

Fig. 4ᵇ.

Fig. 15.

Fig. 16.

Fig. 13.

Fig. 17.

Fig. 6.

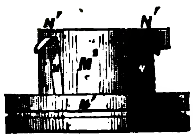


Fig. 7.

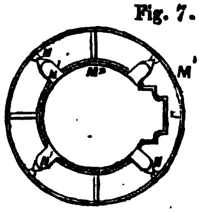
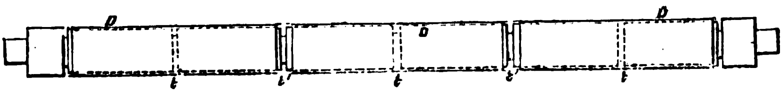


Fig. 14.



may be increased or diminished according to the size of wick to be made), and pass

these threads or strands, without being twisted together, through a gimping machine, by which a single thread is wound spirally round them, in order to hold them together. A strand so formed is represented in fig. 13. Short cylindrical cases of paper are next formed by rolling strips of thin paper twice or thrice round a cylinder, and cementing the folds together by gum or paste.

A number of these paper cases, D, D, D, are then slipped upon a roller or mandril of the description represented in fig. 14; vacant grooved spaces, *t t*, of about a quarter of an inch, being left between every two cases. I next gum the cases all over on the outside, after which I cover the entire series (without regard to the vacant spaces between them) with strands of the gimped cotton of the full length of the roller, and laid side by side, pressing them against the gummed paper, so that they may adhere thereto. I now wind a gummed thread several times round the cotton strands at the parts corresponding with the vacant spaces, t^1 t^1, between each pair of paper cases. As soon as the gummed parts have become dry, I put the roller, with the paper cases and threads upon it, into a lathe, and by applying a knife or knives at the points corresponding with the centres of the grooved spaces, t and t^1, I sever it into twice as many pieces as there are paper cases, each piece forming a perfect wick, with small portions of the threads projecting beyond the ends of the paper. A view of one of these wicks in its perfect state is given in fig. 15. It will be found stiff enough to be handled freely without risk of being injured in shape, and is fitted with great readiness to lamps when required for use.

Sometimes I stiffen the woven wicks of the ordinary manufacture by inserting into them paper cases formed as aforesaid, and gummed on the outside; or, by dipping them (not partially, but wholly) in wax, or in any other suitable stiffening matter.

I am aware that flat and solid round wicks have been before stiffened throughout, but hollow cylindrical wicks, such as those required for Argand lamps, have never, to the best of my knowledge, been before manufactured in a stiffened state ready for use.

Flat wicks may be made of the same materials, and much in the same manner, as the hollow cylindrical wicks before described—that is to say, by attaching strands of the gimped cotton on to both sides of a flat strip of gummed paper. Round solid wicks may also be formed by attaching strands of gimped cotton, side by side, to a solid core of paper, or a strong thread of any fibrous or other suitable material.

I also make hollow cylindrical wicks, solid round wicks, and flat wicks, of two altitudes; that is to say, with the body part of one altitude, and a small portion rising above it to a greater altitude, so that one or both parts may be lighted, according as a weak or strong light is wanted. The higher portion may be made either in one piece with the body of the wick, or in a separate piece, and then gummed to the body, as represented in the side elevation and plan of a flat wick given in figs. 16 and 17, x being the body part, and y the part of greater altitude. Or, the two parts may be quite detached, but used in combination together, for the purpose of giving a weak or a strong light, as required.

Claims (in respect of the improvements before described). I claim the improved mode or means of raising the wick-holder in lamps, as before described, that is to say, in so far as regards the combination of the endless chain with the other parts, or any of them connected therewith.

I claim the improved mode or means of steadying the glass chimneys of lamps, before described, in so far as regards the employment of the broad ring, M^2, and the three-quarter piece, M^3, as solid bearings for the springs, N, N, N, N, and the employment also of the caps, N^1, N^1, N^1, N^1, to cover the tops of the springs.

I claim the manufacture of hollow cylindrical wicks in a stiffened state, ready for use, as before described.

I claim the manufacture of flat wicks and of solid round wicks stiffened throughout in the course of manufacture by any of the modes or means before described.

I claim the making wicks of two altitudes, as before exemplified and described.

MATHEMATICAL PEROIDICALS.

(Continued from page 273.)

XV. — *The Palladium.*

Introduction.—Periodical works, and even others of a *heavier* species, sometimes become notorious from totally different and unexpected causes; and though most commonly a bold expression of opinions contrary to the current, or fashionable cant of the day, is the means by which the name of an author's work becomes inscribed in the annals of fame, yet there are not wanting instances where *obscenity*, *defamation*, *ribaldry*, and *abuse*, have been equally effective in procuring this distinction. Were particular instances required, we

might, in support of the former position, refer to the "Vestiges of Creation," Ward's "Ideal," and the "Nemesis of Faith," as memorable instances of unexpected notoriety; but with respect to the latter position, we know of no works entitled to occupy a place in the same sentence with the earlier numbers of the *Palladium* especially, unless we include the names of two other periodicals with which the "author" was intimately connected. When books, therefore, as well as men, have acquired a Rush-like reputation for *demerit*, they demand a passing notice; and on this account, as well as for the "constant rancour and coarse vituperation towards Simpson and his friends," which run through the work, have the multifarious contents of this periodical been brought under notice in this series of analyses. Evil, however, is seldom unmixed with good, and though the *Palladium* be almost devoid of merit in itself, yet its publication ["together with the prostitution of the *Diary* to the purposes of personal spleen and indecent ribaldry,] gave rise to the two meritorious works last noticed, the *Mathematician* and the "Exercises;" and, perhaps, thus far, and indirectly producing some amount of good ["that good, however, being the farthest possible from the intention or desire of the author of the *Palladium*."] We have also another reason for noticing this work at some length, which may be briefly stated as follows. In describing "Turner's Mathematical Exercises" (*ante* pp. 269—272), we pointed out a few of the bellicose propensities of this *poetical* champion of "art and science," and recounted some "passages of arms" which reflected little credit on his boasted prowess. But as we were *then* almost unacquainted with the work now before us, which may justly be said to constitute the *matériel* of his *grande armée*, we were consequently unable to adjust the "balance of power" between Heath and his adversaries so accurately as could be desired; and as it might be objected that his campaigns had been described, and his "effigies" depicted by his enemies, we are glad to have been afforded the opportunity of adding a few tints to the picture, (through the kindness and exertions of a valued friend,) from perhaps, the only *complete* copy of the *Palladium* in existence; and of allowing this "very particular vagabond" (as he is elsewhere designated), to speak for himself.

Origin.—The first number of this periodical was published in November, 1748, under the title of "The *Palladium*, or Appendix to the *Ladies' Diary*," which, upon the issuing of the second number, was changed to that of *The Gentleman and Ladies' Palladium*. The title subsequently underwent various modifications in order to suit particular circumstances, but having ultimately adopted that of *The British Palladium*, it continued to be issued under this designation until its discontinuance in 1779. The commencement of the work was announced in the preface to the *Ladies' Diary* for 1749, where the author says, "Having extended our scheme for improving this Diary, we are obliged to compose a *Palladium* or appendix to it, of such materials as are connected with, subservient to, and fit to be bound up with the LADIES' DIARY." He winds up his announcement by congratulating the ladies on the appearance of the work, and *poetically* exclaims:—

"Hail, happy LADIES! take your *joys* complete,
Your *Diary* and your lov'd *Palladium* greet.
No tasteless Art degrades your lively *wit*,
Like *hand* and *glove*, so charmingly they fit."

To which he afterwards added:—

"Of *Truth* productive, *Science* to extend,
A *Foe* to Error, and the *Muse's Friend*."

In the preface to the *Palladium* itself we are informed that "this undertaking is at the Request of several ingenious Contributors to the *Ladies' Diary*, to rescue *Science* from the Dominion of *Ignorance* and *Error* (such as *Moon-wise* and *Weather-wise*) and to establish it upon the Throne of Reputation, in the Empire of Truth." He declares his willingness to publish as often as the contributors shall signify to him "their desire of having a New Palladium of Sciences published, in which we shall retail knowledge, *plurimum in minimo*, a great deal in a very little compass, with a variety suitable to each Reader's taste and judgment;" and concludes, of course, *poetically*, with the following "flourish of trumpets:"

"Long in Truth's cause I have been put in Trust,
And to defend her glorious Empire must.
Large Troops of Arguments I do command,
To guard the coast of *Art and Science* land;
A pleasant country, stretching far away,
Wash'd by the waves of Emulation's Sea:
Lock'd by the Land of Ignorance and Pride,
Where *Dunces*, *Pedants*, *Fools*, and *Fops* reside.
PALLAS above had learned me what to do, } *Sic. Orig.*
And now together I my forces drew."
"*Battle with the Boasters.*—The EDITOR."

Editor.—Mr. Robert Heath, sometime editor of the *Ladies' Diary*, author of the "Royal Astronomer and Navigator," &c. Considerable obscurity appears to hang over the *propria persona* of this distinguished individual. His name occurs as a correspondent to both departments of the *Ladies' Diary* in 1737, and in 1744 he was promoted to the editorship as deputy to Mrs. Beighton, the widow of Henry Beighton, Esq., F.R.S., the previous editor. About 1748, he adopts the signature "Upnorensis," to which he adhered for a considerable time, and as his contributions to the *Diary* and *Palladium* from 1746 to 1758 inclusive are dated from "Upnor Castle," it may be inferred that he was employed in some official capacity there, though of what nature it does not *now* appear easy to determine. In the preface to Leybourn's edition of the *Ladies' Diary*, he is styled a "Half-pay Captain of Invalids," and in a MS. note at the end of the *Palladium* for 1779, in the copy previously alluded to, it is stated that "This is the last number published, the author, Captain Heath, dying in the course of this year;"—but whether he was *really* "Captain Robert Heath, of Upnor Castle" does not appear; since upon due inquiry ["nothing is known of such a person having been employed there, and all the official documents of the period have long since been deposited with the Board of Odnance in the Tower of London."] He, however, calls himself "A Military Officer," "An Officer of Invalids," and was "known about Town as Captain Heath," "Deputy Author of the *Ladies' Diary*," "Critic Anser," "Inspector General," and one of the writers in the *Town and Country Magazine*. The last was a monthly periodical ["which dabbled in mathematics, poetry, and scurrility still worse, if possible, than the *Palladium*. It is of so *indecent* a character (says an able authority on these matters, whose opinion so fully accords with our own that we scruple not to quote the extract entire,) that I particularly beg of those *purists* of the present day, who disclaim against the growing depravity of the age, to look through a single volume of the *Town and Country Magazine*, and point out amongst the very worst writers of the present century, taken altogether, so much of gross and corrupt writing as can be furnished from a single number of that work. He will have a hard task who shall undertake it. There was even yet a worse than this; and with this worse was Heath also connected—*The Rambler's Magazine*—a work of which the greatest aim was to avoid a single passage which did not convey an indecent inuendo at the least! As to the scandal respecting persons in every condition of life, it far exceeded the most gross that has ever appeared in the *Satirist* or *Paul Pry*."] With very slight modifications, the whole of the preceding remarks immediately apply to the *Palladium*. Indeed, throughout the whole of the work he ["appears to have been in a state of feud wherever he went, or with whomsoever he came in contact. He *constantly* is in 'hot water' at Rochester; and several of the numbers of the *Palladium* contain not only the most offensive and dastardly attacks upon the Corporation, but even upon the wives and daughters of its citizens! Vulgar terms alone can adequately express a certain vulgar class of persons and qualities, and I think that the account here given" will fully warrant us in affirming that his true character "can only be adequately expressed by calling Robert Heath an 'IRREDEEMABLE *****. *****.'"]

Contents.—To attempt a full description of the contents of this work would almost be a hopeless task. No definite plan appears to have been followed by

the editor in its compilation, unless it be the very *general* one of collecting together a large mass of heterogeneous materials with scarcely any regard to quality or arrangement. The more usual contents, however, are Enigmas, Paradoxes, Queries and Answers, Mathematical Questions and Solutions, Original and Selected Papers on Various Subjects, and a series of Astronomical Tables, entitled a "Royal Diary or Ephemeris."

The enigmas and their answers, generally speaking, are of a very indifferent character, and, in consequence of the pointed allusions and gross insinuations of some, and the barefaced *impurity* of others, demand the strongest condemnation: nor are the queries and paradoxes, as will be seen hereafter, of a much better description. Indeed, it seems somewhat anomalous that such a work should have been established "for the especial *use and delight* of the fair sex;" and even more so, that when established, it should have been enabled to maintain its existence for a period of thirty years.

Among the more prominent of the papers, may be noticed "An Account of the Ecclesiastical and Civil Kalendar;" "The Moral Euclid," a strange attempt to give *mathematical demonstrations to moral maxims;* "Moral Observations;" "Proposals for Building Lazy Hospitals, by the Inspector General;" "Of the Jewish Year;" "Philosophy of Manners;" "Use and Abuse of History;" "A Dialogue between Stationers' and Surgeons' Halls;" "The Perpetual Diary;" "Roster General for detaching Regiments;" "A Plan of the Military Art, according to Modern Improvements," dedicated to Lord Ligonier; "On the Wisdom of God in his Works;" "Newton's Chronology;" "The Errors of Kennedy's Chronology;" "Longitude Ode," an attack on Mr. Mitchell and Dr. Maskelyne;" "Select Maxims and Observations;" "On the advantages of Enemies;" "Chronicle of Remarkable Events;" "Grammar of the French Language;" "Lists of the Origin of Customs, &c.;" "Rules for the formation of the Palladium Society;" "Description of the Palladium Button, to be worn by the Contributors;" "Introduction to Geography;" "Moral Observations for Schools and Academies;" &c., &c. The mathematical papers contain—"A Method to find a Planet's Place in the Orbit, from having the mean Anomaly given;" "Theory of the Moon's Motion;" "On Eclipses;" "Analytical Expressions for a Planet or a Comet's Orbit;" "The readiest Method of finding the Eccentric from the mean Anomaly in any Orbit;" "Universal and Easy Solution of the Keplerian Problem;" "A Full, Complete, and True Answer to an Astronomical Question;" "On the Longitude, by a Sea Officer of the first rank;" "To find the Longitude at Sea;" "A New Method of Longitude;" "Remarkable Properties of Numbers;" "A Mechanical and Universal Rule of Proportion, by the Palladium Author;" "A Proof, to the Commissioners of Longitude, of the Defects of Mr. Mitchell's Rule," &c., &c. Most of the above papers are of the most worthless character, and appear to have been introduced for the purpose of affording an opportunity to asperse the characters of Messrs. Lyons, Dunthorne, Irwin, Harrison, Whiston, Ditton, Kennedy, Maskelyne, Mitchell, and others; upon whom the editor and his correspondents well nigh exhaust the English language of its most abusive and insulting epithets. What were the primary motives which caused Heath to manifest such bitter animosity towards Simpson, Rollinson, and Turner, can scarcely now be determined. It has been conjectured, with much probability, that as ["Simpson was appointed to the R. M. Academy in 1743, and as it was just then that Heath commenced his violent attacks, it is therefore probable that he was a candidate for the appointment; and many of the earlier attacks upon Simpson almost enforce upon one's mind the existence of some such cause as this operating upon a vain and violent man. In fact, some of them are scarcely compatible with any other hypothesis."] Be this as it may, his rancour makes its appearance in the first number of the work; nor did he cease to traduce Simpson's memory to the end of his own career. On page 11, Simpson is accused of having in his Fluxions followed "De Moivre and some of the foreigners," respecting the *slowest* increase of Azimuth; and in the same page, he is said to be "wrong in the transformation of a fluxion;" but "this is observed rather as the author's want of care than of judgment." The editor, however, *kindly*

adds, "We shall continue to observe other mistakes, in hopes of being informed at any time of our own—truth being our principal aim." In 1750, the Prize Question is answered by "*Mr. Nehemiah Woudbe*, F.R.S.," obviously in allusion to Simpson's title, since Heath, for distinction's sake, signs himself "Mr. Heath, *non* F.R.S." On page 47 an advertisement appears, declaring that, "for the benefit of this nation, soon will be published, The Inspector General," in which "first, we shall begin with an *Oration* on the *Abuses* and *Corruptions* of Endowed Schools, whereby the *British* Youth are greatly prejudiced in their *Education*, *Morals*, &c.;" and on page 63, among the "books to be published," is found, "An *Incomparable* Treatise of *Fluxions*, by T. S., F.R.S., an *Incomparable* Author." The *Palladium* for 1751 contains an absurd prescription how to form "a modern mathematician," among the ingredients for which are, "six of Heath's Logarithmical exponential Equations; all De Moivre's, Muller's and Simpson's Disputes, with his late whole Doctrine and Application of Fluxions:" the directions fully carried out, are said to cause any "intended artist" instantly "to become a famous mathematician, fit to be made professor of geometry, astronomy, algebra, fluxions, gunnery, and fortification."

The application of this extraordinary tirade to Simpson and his friends is made by Heath himself, in one of his letters to the *Daily Gazetteer*, see *ante*, p. 269-272. At pages 52-3, he falls foul of De Moivre's and Simpson's Annuities, &c.; and, amongst the "Improvements in Titles," p. 63, a suggestion is made that Simpson should change his to "The Effect defined for the Cause; or, Magnitude for the Motion, in the doctrine and Application of Fluxions." In 1752, the 27th query asks, "What is the reason that a late useful *production*, begot by a F.R.S., christened by the name of *Mathematical Exercises*, and nursed by an *Apple-monger*, should come to an untimely end, after six months." The answer in the following number, however, is such as to imply that the work was not so *dead* as the author of the *Palladium* could desire; it is as follows:—"*Promising geniuses* are observed to be soon cut off," and it "is as infallibly dead (*to sense and reason*) as Dr. *Dove's* horse *Nobbs*, that was flayed alive." Page 34 contains another attack on the Annuities, and in the list of "books to be published," is the "Mathematical Dunciad, containing an Account of *mere* Mathematicians;" whilst, for "Improvements in Titles," we have "*Libels* and *Malignant* Exercises for *Mathematical*," and "A False Definition applied to a New Method of Fluxions, by F.R.S."

The *Palladium* for 1753 makes a sneering inquiry respecting Mr. Landen's mistakes and his signature, "Waltoniensis" (query 41?) the answer states that his "godfather was Upnorensis, who first adopted him his son," and that "his reproaching Mr. Emerson, Mr. Heath, &c., is from his *bias* more than sagacity." Mr. Landen's application of the terms "Critic Anser," it seems were neither forgotten nor forgiven; for at a much later period, Heath rejects a question proposed by Mr. Kilwin, because "our plan is not to insert questions concerning *Series* or *Fluxional Equations!*" Pages 61-2 contain a request that the "contributors and public" will "excuse the errors and absurdities in this year's *Ladies' Diary*, we not being allowed the correction of the proof sheets *for dark reasons;*" and also the attempt to obtain possession of the letters intended for the *Diary*. The "dark reasons" are nowhere explained, but they may easily be gathered from the preceding observations. Simpson was now appointed editor of the *Diary*, and Heath "being firm in the widow's cause, while the *mercenary* seek to oppress," had his revenge by desiring "the contributors to excuse *Mr. Lundy Leatherhead* and his partner, *Mrs. Clackit*, pin and card cutters, and *four ears*, for mangling their schemes and reputation for *one year* only."

The preface for 1754 makes a dash at "the *other Diary*" (*Gentleman's*), but from the *very* few, and, comparatively speaking, *mild* remarks concerning that work, one is led to infer he did not dare to offer any violent attacks on either the editors or their correspondents, or, which perhaps is more likely, there did not exist any *inciting* cause for rabid animosity. The first enigma is in the form of a "Pastoral Dialogue, between Amanda and Lucinda, lamenting the hard fate of

a LADY, not long ago the DARLING of the FAIR SEX;" this and the next are by "Upnorensis," and contain a true Jeremiad on the loss of the *Diary;* indeed, nearly all the rest of this year's compositions are melancholy *solos* in the same flat key. On page 34, George Brown, of Oxford, finds fault with a solution in the "Mathematical Exercises," because "a *general* is deduced from a *particular* solution." He styles Turner "a low-life animal, who is not capable of hurting anybody but with his tongue;" and, as might be expected, Simpson also comes in for a share of the following "advertisement."

"In Conundrum-court, London, gold plates are completely fitted to the rough of the mouth, so as to prevent speaking through the nose, whether from a *natural* or ****-**** defect of the *speaker*, either of short duration or long continuance. By

"TOM STIFF, } Operators."
"TOBY STRUTTER, }

In the *Ladies' Chronologer* for this year, he informs the public that, "in consequence of ill-treatment," he "declined writing the *Diary* (*Ladies'*) any longer," but will publish the *Chronologer* "to make amends." Its contents are of a similar character to the *Palladium*, the Jeremiads included; but the 46th query asks, "if the author of the *Palladium*, and late author of the *Ladies' Diary*, is a person of '*no science or genius*, and yet was so near ruining the *Diary*,"... "what may the danger not be from those three *surprising geniuses, Miss Umbra Billingsgate*, Amanuensis; *Thomas Opacus*, Projector; *Monoclus*, Luminary; besides *others*, learning to spell; one of which, and his works, we are told, 'are known to the greatest mathematicians of Europe?'" Towards the close of the number, Simpson, Turner, and others are pointed out by *name* as "reptiles of earth;" and "The History of one Rollison, born and bred up at Sheffield," is deferred. The deficiencies of the *Diary* form the "burden of his song in the title-page of the next *Palladium*, and Simpson's Fluxions are again condemned in the preface. On page 14, Mr. William Swift advises "Amanda in Smart, with her *Diary* to part"—to

"Take some good gin, and let them laugh that win,
Such Diarian trifles t' oppose;"

whilst "Elizabeth Ganning, in the character of *Diaria* turned *gypsey*, on her being *ravished*," declares that

"*Diaria*, ravished of her store,
Tramps now, Jew-like, from door to door."

Further on in the number, we find a "Dialogue, by Tom Tickle, of Prickle Hall, in the County of Quickset," in which Surgeons' Hall exclaims—

"Bid Turner, ignorant derider,
Mind how to *brew* his master's cider.
Simpson to Bosworth bid repair,
There *weave* his cobwebs in the air;
There propagate fictitious lies,
And calculate nativities."

On the next page we find an "Epitaph" for the *Diary* (*rather premature*, the present editor would say), and an "advertisement against *suppressing what is useful*, and *seizing another's property*," concludes his doings for this year. During the next two years, we have well nigh a cessation of hostilities. In the preface for 1756, some "*unfair practices*," by "persons who are only *pretended* friends to the proprietor of the *Ladies' Diary*," are hinted at, and the "*fact*" of the work "*being sunk*," is stated in an inquiry respecting the "Famous Author." Some obscene verses, entitled "Consolation, by a *Simpsonian*," are found in the *Palladium* for 1757, and a set of "New Frontispiece Verses, for the *Ladies' Diary*," and "A New and Important Problem, by a *Simpsonian*," occur on page 46. These verses were composed to ridicule questions 406, 412, 413 of the *Diary*, and, though sufficiently absurd, might have been overlooked had not the author on the next page unblushingly inquired, "Why the *author of the Diary* wears horns?" Query 84 asks, "Whether *Mr. Simpson's* late *pretty* book, entitled, *Miscellaneous Tracts on some Curious and Interesting Subjects*, is not like a *tinder-box* or a *dark lanthorn?*" and query 85 inquires, "Which is the most ingenious and reputable profession, a *Fortune-teller*, *Almanac-maker*, *Haberdasher* of Mathematical Problems, or Mrs. *Phillips's* trade, in *Half-moon-street*, near the Strand?" The answer, by Mr. Brown, to the first of these queries, in the next *Palladium*, merely ridicules the "Tracts;" but the "*Archbishop of Toledo*," in his answer to the second

query, after stating that "a *Haberdasher* of *Conundrums* and *Mathematical Problems*, disingenuously disowns his performances in the *Ladies' Diary*, from an apprehension of being exposed by the *critics* and men of judgment," makes a comparison between *him* (*Simpson*) and Mrs. Phillips, of so obscene a character as to be unfit for publication here. Query 69 states that "COMMON SENSE (in the genuine acceptation) is little understood by *mere mathematicians*, *Woolwichensis*, *Birchoverensis*, *Laudenians*, *Simpsonians*, *Marmaduke Hogsons*, *&c.*, being chiefly the talent of PHILOSOPHERS, and not of the *vulgar*." And on page 49, the "*Diary* author" is *again* reminded of his "*horns*," whilst the next page charges him with dishonesty in seizing the *Diary* "from the *widow* proprietor," and also likens him to "a *Dutch boat* of two *oars*, with a couple of *logs* towing astern." In 1760, we are told, it was by Mrs. Beighton's "*sprightly* talents and solid *judgment*, that the *Ladies' Diary once* flourished with *unrivalled* reputation;" and in the following number, query 127 proposes that "a *gingerbread bridge*, of eleven separate arches, is to be built against the next horn-fair, near *Woolwich*, for the entertainment of the curious: required of Mr. T. S., F.R.S., *usurper* and *principal compiler* of the *Ladies' Diary*, the exact dimensions and form of the arches."... In this number occurs "The Humble Petition of *Least* to *Little*," which "*humbly sheweth* that your petitioner, *Least*, is in danger of being superseded in his promotion by *Lessest*, as *Less* has been superseded by *Lesser*, for several years last past; though it does *not appear* that ever the said *Less* forfeited his duty, so as to deserve the said Lesser to be put over his *head*."... And further on, we find a proposal for the publication of an "Original Ladies' Diary," and also a notice to correspondents, stating that "the *Palladium* author is present proprietor of the *original Ladies' Diary* since the decease of the late Mrs. Elizabeth Beighton."

In 1762 the purport of the petition, and the claim respecting the *Diary* are explained:—*Rollinson*, "the *Lessest*," is promoted to the editorship of the *Ladies' Diary*, on Simpson's ("the *Lesser's*") decease, *over the head* of Heath, "the *Less*." On page 19, he deploringly relates that the "*Diary* (some time *usurped* by *Mr. Simpson*, lately deceased) is now ravished from us and done by other hands, and not by the friends and heirs of the late *ingenious* Mrs. Beighton, deceased;" and further on, after repeating the same "doleful ditty," he despairs of republishing the *Ladies' Diary* enigmas and questions as he had announced, and proposes to the *eight* subscribers *to supply them with copies of his "Royal Astronomer" instead*, upon each paying 2s. 6d. *extra* for a *sewed*, and 5s. *extra* for a *bound* copy, rather than "*return their half-guineas!*" Next year his correspondent, Mr. G. Brown, of Oxford, falls foul of Simpson's Fluxions, and "the *Diary*, as conducted by *him*," though the editor himself allows, for the *first time*, perhaps, p. 46, a legitimate reference to Simpson's work. In 1765, *four* years after Simpson's death, and *fifteen* after the charges were made, Heath volunteers a reply to "a *vulgar error* fallaciously propagated for bye ends, by *certain persons* (since the year 1754, inclusive), *of the Palladium author having unjustly taken the Diary correspondents'* BEST THINGS *to insert in the Palladium, during his compilation of the Ladies' Diary* from 1744 to 1753, inclusive, *for his late worthy friend Mrs. Beighton, the widow proprietor*," and endeavours to clear himself from the imputation by asserting, with all the coolness imaginable, that "the contrary to which hence appears," since "better *enigmas* and *pieces of poetry* are inserted in the *Ladies' Diary* by the *Palladium* author *than are inserted since his time of compiling it!*" He then charges the editor of the *Diary* with introducing "awkward and difficult *mathematical* questions, of little use and invention, and *low subjects* void of taste and humour, and even of common sense and spelling:" says "the work is now sunk" and "disgraced by a *clumsy wood-cut figure* of a *lady* on the *Diary* frontispiece:—that some of the *Diaries*, since the *Palladium* author's time of compiling them, have been printed on no better than *ballad-paper*;" and, as he warms with his subject, he anon becomes *poetical*, declaring that

> "The *Ladies' Diary*, *once* well known to Fame,
> *Now* casts dishonour on the lady's name!"

The charge of "introducing *things* giving offence" is next taken up, but instead of making any apology, he unblushingly declares, "that every *Diary* or *Almanack*, before it can be published, must be licensed by his *Grace of Canterbury*, the *Bishop of London*, or their *Chaplains*, according to a grant from the Crown to the Stationers' Company. Therefore, *no blame* can fall upon any *Diary author*, or *compiler*, nor yet on the *Company of Stationers*, for what is *licensed to be printed as aforesaid!*" In the same "Apology" he sneers at the notion of "a *mere mathematician*" (Simpson) being considered able to "furnish materials of fit entertainment for *ladies* and the general reader;" and after dealing the treasurer of the Stationers' Company a back-handed stroke for taking "the *Ladies' Diary* copy from Mrs. Beighton's compiler," and giving "it to his *namesake* of Woolwich Academy, without giving the *Palladium author*, or former compiler, a reason for so doing," he *again* becomes *poetical*, and deploringly exclaims:—

> "O grief of griefs! thou shade of Tipper mourn,
> Diaria doats, in LOVE at *sixty-one;*
> Her REASON gone, appears a stupid log,
> Dreams of her coach, though not worth half a hog.
> *Barbers*, *weavers*, gardeners, all conspire,
> And epith'lamiums sing as dirges dire!
> . . . .
> O shade of Tipper, shade of Beighton come,
> And save your darling from oblivion's womb!"

During the next two years the *shade* of Simpson is suffered to rest in peace, if we accept an insinuation that "the tables (astronomical) *said to be had* from Mr. Simpson, of Woolwich, Simpson had, doubtless, from Dr. Bradley, to examine before his observations were completed," but, in 1768, the attacks are renewed with increased vigour. In the preface he congratulates the *Palladium* on having attained to its "twentieth number . . . notwithstanding the discouragement and opposition it has met with from the several *pretenders* to science." He observes to his correspondents "that their compositions sent *elsewhere* are more to the purpose, or more elegant and useful," and wonders at them "for sending us *queries* and matters they send elsewhere; making *alliances* with *distributors* and *compilers* of other productions, who have *imposed* on them." Further (on page 69), he ridicules "the wits and Philomaths;" insinuates the pilfering of his proof sheets; relates a story of his own "cleverness," with as much apparent simplicity as Rush did that of "Dick, Joe, and the lawyer;" and, lastly, winds up by the *means* by which a *trickster* "gained his cause against men of honour and reputation . . . Yet this *scoundrel's* iniquity, with his meanness and malice, has been covered over by plausible pretences, and the help of a worthy *lawyer* and pious *advocate*, and himself promoted, by his *servility*, to an ample benefit under the Government, without *gentleman's* accomplishments or equal abilities." In succeeding *Palladiums* he takes occasion to abuse the Board of Longitude, Dr. Maskelyne, Mr. Mitchell, "who," he says, "has never appeared much of an author since Simpson's death, till he fell in with his other friend, *le Docteur*," Dr. Hutton, Mr. Ferguson, and several other "*watch joiners*, *illiterate pedants*, *charity-school teachers*, and the *workers* in *brass* and *steel;*" he also inserted a gazette in French, containing "*Promotions dans les Regions de la Lune*," in which the same and other personages are represented as holding offices in the lunar regions, too gross and disgusting for the English language to express. He seems to have allowed Dr. Hutton, personally, to escape with merely a rebus expressive of his "being in favour with the ladies;" and somewhat curiously endeavours to depreciate the character of Dr. Bradley by insinuating that he "*was assisted by Simpson of Woolwich, his neighbour;*" though he had previously stated that Simpson had pilfered "*the tables said to be his*" from Bradley! On the appearance of Burrow's *Lady's and Gentleman's Diary*, one of the correspondents to the *Palladium* finds

fault with Burrow for putting "the cart before the horse" in the title; he speaks very disparagingly of the work itself; calls the geometrical problems and constructions "trifling," and thinks "nothing at all" of the "set of questions." In 1778, the "*Palladium* author," again enumerates the "elements" necessary to form "a *real* mathematician," and remarks that "a hundred dozen of *versifiers*, *philomaths*, and *dogmatists*, will not make one *real* poet, mathematician, or philosoper, respectively . . . . which in one age, are like the *Rara Avis in Terris*, *nigroque Simillima Ligno*, A Phœnix." His observations on this subject are much less personal than usual, which almost induced one to hope that age had taught him wisdom, but having taken occasion to speak favourably of the performances of Mr. W. Veck, "by a *fallacious* recommendation," in the next and last number, he retracts his former opinions, and having overwhelmed the luckless wight with a torrent of abuse, he makes his exit from the stage of the *Palladium* and the world, very properly (page 75) inquiring "the situation of the place of purgatory."

Questions.—The total number of questions proposed and answered in this periodical is 631, exclusive of several sets from the *Ladies' Diary*, and one set from the only number published of the *Ladies' Chronologer*. The final collection of 25 was left unanswered on the discontinuance of the work. The majority belong to algebra and its applications, and though they present but few points of interest, some of them at the time may have formed useful exercises in the *practical* application of formulæ. Indeed, the editor appears to have had no desire for questions of a speculative or geometrical character, as his *proof* of the *correctness* of a solution appears to have been derived from the *agreement* of his correspondents in the *numbers* deduced from their investigations. A glance at some of the editorial remarks will show that when this happened *not* to be the case, the questions were suffered to remain in *statu quo*, whilst the proposer not unfrequently met with a full share of insulting observations. Did space permit, it would be an easy, though not a very desirable task, to exhibit a more ample collection of offensive observations, degrading epithets, coarse vituperations, and downright abuse, *personally* applied to the correspondents of the *Palladium* by this "Champion of Truth and Science," than could be procured by the most diligent collector from all the other works of this description put together. He was equally inordinate in his praise of a select few, who appear to have somewhat humoured, and perhaps enjoyed, his unaccountable vagaries. Mr. Emerson was one of these, whose works the editor never omitted an opportunity to recommend; nor must the name of Thomas Huntley be omitted, since his questions, solutions, &c., in Greek and Latin afford a specimen of *absurd pedantry*, only exceeded by the editor himself when he introduced queries, &c., in the Hebrew, Greek, Latin, Italian, Spanish, Portuguese, French, and English languages!

Ques. 17, gives three circles to find a fourth to touch the other three *interiorly*.

Ques. 2, p. 29, *Pall.* 1755, determines the radius of the first inclosed circle in the Arbelon of the ancient geometers.

Ques. 157 relates to a sphere immersed in a conical glass, but the results not agreeing, "the solutions are left to be examined."

Ques. 187, is a case of Towneley's proposition in the *Phil. Transactions*.

Ques. 332 is said to be from Stone's papers, and finds the point within a trapezoid, the sum of whose distances from the corners is a *minimum*.

Ques. 351 is by the *Palladium* author, and requires a point in an ellipse, or oval, such that the sum of its distances from the three angular points of a given right angled triangle may be a given length. After its proposal he remarks that he has "omitted all merely speculative or physical problems, and inserted *practical* ones." The answer is by the proposer, "no other solution being offered," and affords one of the best possible specimens of what an "*original* genius" can effect by means of a "silk thread" with "loops at the ends" and putting "a pin, with the tail clipped off, into each of those points, each pin being clipped asunder a little below the head, and made sharp at the *contrary* end, for the head to stand a little above the paper."

Ques. 409 finds the greatest ellipse which can be inscribed in the given sector of a circle.

Ques. 420 relates to a series of spheres inscribed in a cone; it was proposed by Captain Williams, and was solved by himself and Mr. Coughron, two of the best correspondents of the *Palladium*.

Ques. 431 finds the side of a square when the distances to the angles of the figure from a given point *without* it are known. This question had been given before in the *Gentleman's Diary* for 1751, and has often been treated since; Mr. Coughron gives an elegant geometrical solution founded on a lemma in "Simpson's Algebra."

Ques. 490 gives "the hypothenuse of a right-angled triangle and the side of its inscribed square, to find the other parts," which is elegantly solved, geometrically, by Mr. Coughron, as is also Ques. 492, relating to projectiles, proposed by Captain Williams.

Ques. 546 constructs the trapezium inscribed in a semicircle when the two opposite sides, one of which is the diameter, and the angles at the intersection of the diagonals are given. The editor, in some remarks at the close of the solution, refers for "*geometrical reasoning*" to "*Simson's* not '*Simpson's* Geometry.'"

Ques. 591 is the same as Prop. 57 "Simpson's Select Exercises," and, singularly enough, both the proposer and the author referred to, escape without one word of reprobation.

Ques. 619 constructs two *different* right angled triangles, such that the inscribed circles are of equal magnitude. The question was answered by Messrs. Sherwood, Fletcher, Robinson, Cartill, Sanders, Rowe, and James; but as their results did not agree, the *Palladium* author asks, "*Where is the diameter of the circles, to compare with the conclusions of others, and prove the truth of the process and conclusions?*" He offers some further remarks on the subject at the close of the next solution, and dismisses his correspondents with an order for them "all to go to work again to find out infallibility."

Contributors.—Messrs. Allen, Baker, Bolton, Boyce, Brown, Buddle, Cartill, Chapple, Clarke, Coughron, Cowper, Dalton, Dixon, Drummond, Emerson, Eyre, Fletcher, Hardy, Holden, Hulse, Huntley, Hartley, James, Jepson, Johnson, Judson, Knowles, Langley, Lomax, Lyon, Mouldsdale, Nicholson, Orchard, Robinson, Rowe, Sadler, Shadgett, Sharp, Sherwin, Smith, Terey, Veck, Walker, Wilkinson, Williams, &c., &c.

Publication.—The various numbers of the work were issued annually, about the month of November in each year. The prices of the numbers varied according to circumstances; and, as the editor changed his publisher almost every year, it is unnecessary to enter into further particulars.

THOMAS WILKINSON.

Burnley, Lancashire,
May 9, 1849.

DAVIES'S ROTARY ENGINE.

Sir,—I would have replied earlier to "A. Z.," but have lately been from home, and my attention has been much engrossed with other matters.

If "A. Z." had stated in the outset what he meant, it would have saved him the inconvenience and trouble of explanation, for I certainly should not have contradicted the fact, "that a reciprocating engine may be started without a flywheel if the crank be placed 15° or 30° beyond the line of centres;" but, I must say, that I was somewhat startled to read in the pages of the *Mechanics' Magazine*, that in a reciprocating engine, "the fly is requisite to carry the crank through only about 15 degrees on each side of the line of centres." I am willing, however, to concede that this is a *lapsus pennæ*,* for I cannot conceive any one so ignorant of its action as not to know, that for the equalization of power the fly-wheel is *requisite throughout the entire revolution;* that its operation is not confined to 15° or 30° on either side of the centre; but that it is constantly active, either absorbing, or imparting power—absorbing power, if the force communicated from the piston be above the mean, and imparting it when it is below the mean power given off the crank shaft. One observation more I wish to make before leaving this part of the subject. "A. Z," says, "or to avoid all dispute, say 30

* I may here observe, that I am not aware of any particular virtue the fly-wheel possesses for starting the engine; it is *after* motion is imparted to it, that it becomes serviceable.

degrees beyond the line of centres; but Davies's engine could not be started until the piston be 60 degrees beyond the line of centres." Now, as in reciprocating engines, the crank passes the line of centres twice in each revolution, it must be 30 degrees out of centre four times during that period; therefore, $30° \times 4 = 120°$ for the reciprocating engine, and as Davies's passes the centre but once during each revolution, the ports are closed through $60° \times 2 = 120°$. Thus, according to "A. Z.'s" premises, reducing both engines to the same standard; but as he neglects to observe this in his argument, his conclusions, even if we admit his data, are erroneous.

"A. Z." asks, "is a rotary engine sold by weight"? I am not aware of having offered him one for sale; or, of even speaking of the price, except *comparatively*, and for a rough *comparative* estimate in the absence of other data, the weight would be a clue sufficient for our purpose.

The concluding paragraph, "A. Z." puts much clearer than it was in his former letter; but in the few last lines he again opens the subject of the dead points which in the former part he wished to leave to the judgment of your readers. I am therefore obliged again to tell him, that Davies specifies for *two engines* working together on the same shaft, and that, *thus combined, there is no dead point.*

I am, Sir, yours, &c.

WILLIAM DREDGE.

London, 10, Norfolk-street, Strand,
May 3, 1849.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 18TH OF MAY.

JAMES ANDERSON, Abbotsford-place, Glasgow, A. B., starch manufacturer. *For an improved mode of separating the different qualities of potatoes and other vegetables.* Patent dated November 11, 1848.

The patentee states that he has ascertained that the specific gravities of potatoes and other roots or vegetables increase in proportion to the nutritious matter contained in them; and it is the application of this principle which constitutes his invention. For instance, the specific gravity of the potatoe varies from 15° to 24°., Twaddell's hydrometer; and he proposes to place a quantity of them in a mass of water which has been brought, by the admixture of salt, clay, &c., to the requisite degree of specific gravity, say 20°, Twaddell's hydrometer. The heavier, and consequently, the most valuable, will sink to the bottom, while those possessing the opposite qualities will float at the top. The two qualities may be further divided by repeating the operation.

Claim.—The system, process, or method of assorting, separating, or dividing potatoes or other like roots or vegetables into classes or qualities, according to the ratios of their specific gravities, by means, or the use of water or other liquid, the specific gravity of which is in accordance with that of the class to be obtained, by whatever means or manner of it may be applied or produced.

JOHN BROWNE, Osnaburgh-street, Middlesex, gentleman. *For improvements in fire-escapes, and in apparatus to facilitate persons employed in cleaning windows.* Patent dated November 11, 1848.

A platform, to which the inventor gives the name of "balconlieu," is to be placed outside the window on which the persons engaged in cleaning or painting it are to stand. It is supported upon the ends of two bars of wood, strengthened by plates of iron, and placed at a suitable distance from each other. The other ends of the rods are perforated with several holes, into which are dropped two pairs of pins, whereby the "balconlieu" is maintained in position in the same manner as a common glazier's platform. A cross-bar is affixed to the inside ends of the rods by one of the pairs of pins, which has the effect of increasing the stability of the structure. The "balconlieu" is furnished with a drop-bar underneath, which projects obliquely against the outer wall and serves to steady it, and also with railings, which support a canopy, to prevent the persons from falling, and to shield them from the weather. It is, moreover, fitted with a wheel at one end, to facilitate its removal from place to place—with projecting pieces for the men to stand on—with supports for their cans—and with a moveable saddle-piece for them to sit upon. A modification of this apparatus consists in uniting two ladder-like frames together, which support a saddle for the man to sit upon at work.

The fire-escape consists in attaching a knotted rope to the "balconlieu."

No claims are given in this specification.

ALEXANDER PARKES and HENRY PARKES, Birmingham. *For improvements in the manufacture of metals and the alloys of metals, and in the treatment of metallic*

matters with various substances. Patent dated November 11, 1848.

These improvements consist in roasting the carbonates or oxidized compounds of copper, either alone in a calcining furnace, as is done with the sulphuret ores of copper, or in combination with any sulphuret except that of copper, or an acid or alkaline substance, or their salts, and metallic iron, in order to facilitate the after process of smelting or reducing. The compounds of copper may be purified of some of their ingredients by calcination simply, but when these impurities are arsenic or antimony, a quantity of muriate of amonia, or chloride of sodium or barium, equal to that of either of these ingredients in the metal, will have to be used. The purifying material is mixed with an equal quantity of some carbonaceous substance, which is added to the copper compound little by little. When the carbonate or oxidized compound of copper contains less than from 10 to 15 per cent. of the metal, the proportion of sulphur, either in a pure or compound state, to be used, is one-quarter of the quantity of copper; and when it contains more than 20 per cent., the proportion should be 1 of sulphur to 5 of copper.

The patentees propose to employ a reverberatory or blast furnace, and to cause a current of steam, or air, or other gaseous body, to impinge upon the surface of the compound, whereby a sulphuretted hydrogen gas is generated, which acts upon the sulphurous vapours, and facilitates the collection of sulphur in the passage to the chimney.

Sulphuret of lead and carbonate of lead may be mixed together in the proportion of 1 to 2, and submitted to the ordinary process to obtain the metal from both.

To obtain the metal from carbonates or oxidized compounds of copper, it is proposed to employ the stearates or oleates of lime, calcium, or baryta, or any gum, resin, or fatty body which can be conveniently obtained. Or, the sulphates of copper, or the chlorides of sodium, calcium, manganesium, or strontium, and metallic iron may afterwards be added in the proportion of from 300 to 500 cwt. to every ton of copper ore containing 30 per cent. of the metal. When the metal is difficult to fuse, any suitable flux may be used; but one composed of 2 parts of chloride of sodium and 1 part of coal is stated to be preferable.

An alloy of copper and zinc is produced by operating upon the carbonates or oxidized compounds of these two metals, or by adding zinc in a metallic state.

The improvement in alloys consists in fusing a metal or metals, or alloys of metals, and adding phosphorus thereto during that operation. The proportions and metals may, it is stated, be varied; and the patentee gives, as an example, eight tables, divided into two sets, one for the production of an alloy suitable for the manufacture of sheathing, printers' rollers, &c., and the other for castings.

No claims are given in this specification.

Samuel Adams, West Bromwich, Stafford, organist. *For improvements in mills for grinding.* Patent dated November 16, 1848.

These improvements refer to metal mills, and consist in making the fixed cutter with a conical hole having steel teeth or ribbed surfaces; and the moveable cutter with a conical periphery (but in the reverse way) also furnished with steel teeth or ribbed surfaces, and with planes which have the effect of guiding the material between the cutters. This moveable cutter is supported in an adjustable bearing to allow of the distance between the edges of the two cutters being regulated according to pleasure. The wheel-work is inclosed in a conical shield, which prevents the substance to be ground from coming in contact with it, and with the upper edge of the moveable cutter, and guides it between the cutters.

Claims.—1. The application of the shield.

2. The application of the projections, surfaces, or planes, and the construction and arrangement of the cutters.

Alexander Balfour, Dundee, Scotland, leather merchant and manufacturer. *For improvements in apparatus for cutting metal washers and other articles, and in the construction of buffers.* Patent dated November 16, 1848.

The improvements refer, 1, to a fly press; 2, to a lever press; 3, to a rivet cutting apparatus; and, 4, to railway buffers.

In the fly press, the lever arm, instead of being attached directly to the bolt, is fastened by a nut and screw in a slotted quadrant, which is connected to the top of the bolt, so that the handle may always be conveniently placed for the workman, and the distance it is to be moved regulated according to the work to be performed. The brass in which the screw part of the bolt works is maintained in position by a collar at bottom, which catches against the frame, and at top by a ring, shrunk on over two half rings, which are made to take into a groove cut in the brass.

In order to prevent the die descending too far down, adjustable stops are affixed to the bolt by screws, and catch against a collar fixed to the frame.

The frame supporting the bush, in which the bolt slides up and down, is of a square

shape, divided diagonally, and has prolonged ends furnished with screws. The spaces between the diagonal halves are filled with several sheets of paper, and the space around the bolt is then filled with melted tin. The bush will thus be in two parts, which, as they wear away, may still be kept in contact with the bolt by removing one of the sheets of paper, and screwing up the ends of the frame.

In order to make the central hole of the washer concentric with the exterior circumference, it is first punched out, and the washer then placed under the shaping die, which is furnished with a conical projection at bottom, so that as the die descends, the cone will have the effect of bringing and maintaining the washer in the correct position.

The stamped piece of metal is removed by the passage of a rod through the die-plate, and which is suitably supported and guided in its course by a rectangular frame attached to the bolt.

The *lever press* has the forked end of the connecting rod fitted with a cross-head, in which works a screw, the ends of which are held in the opposite sides of a slot cut in the free end of the lever, so that the distance between the centre of the cross-head and that of the crank-shaft may be regulated as required.

The *rivet-cutting machine* consists of a pair of rollers, which feed the rod into the conical mouth of the fixed cutter. The moveable cutter slides up and down against the other end, and carries a ledge, which moves with it and supports the end of the rod.

The *improved buffer* consists in having the head attached, independently of the stuffing and exterior casing, to the end of a rod, which slides freely in a plate fixed to the carriage or engine.

Or, the buffer head may be affixed to a cylinder, in addition to the rod, sliding within the casing. The stuffing is to be composed of Russian bristles or compressed cork. In order to lessen the suddenness of a shock, it is proposed to notch the inner ends of the rods, and to cause them to take into coiled springs.

Claims.—The apparatus for cutting metal washers and other articles, as described.

2. The construction of buffers, as described.

WILLIAM WILKINSON, Gateshead, Durham, coke manufacturer. *For certain improvements in the construction of coke ovens, and in machinery or apparatus to be connected therewith.* Patent dated November 16, 1848.

1. The coke ovens are built with flues in the walls, which are furnished with lateral holes, whereby the air is supplied to the interior (instead of through the door, as hitherto), and is equally distributed over the burning mass.

2. In front of the series of ovens is a rotary shaft, on which are placed pinions, that may be moved to the right or to the left, and consequently made to gear in or out of racks cut in the ends of rods, which are thus caused to slide horizontally just above the floors of the ovens. The inside ends of the rods carry oblong iron plates, which, as they travel forwards, force the coke out of the oven.

3. The patentee proposes to economise the heat resulting from the charring of the coal, and to apply it to the evaporation of saline solutions, by causing the flues from the ovens to pass underneath an evaporating pan. The temperature of the flues is regulated by means of two furnaces at each end, which serve also to consume the gaseous products. A crystalizing pan is put in communication with the evaporating pan, and is fitted with furnaces to precipitate the salt.

Claims.—1. Forming the walls of coke ovens with flues having lateral openings, for the purpose of supplying air to the interior, and diffusing it equally over the burning mass.

2. The mechanical means, or any analogous arrangement for discharging the coke.

3. The mode of economizing the heat produced from the coke, and applying it to the evaporation of saline solutions.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Charlotte Smith, wife of Jabez Smith, of Bedford, for improvements in certain articles of wearing apparel. May 14; six months.

Samuel Allport, of Birmingham, gun-maker, for a certain improved method of making or manufacturing a certain part, or parts of looms used in weaving. May 14; six months.

William Phillips Parker, of 48, Lime-street, London, gent., for improvements in the construction of pianofortes. (Being a communication.) May 15. six months.

John Thom, of Ardwick, near Manchester, calico printer, for improvements in cleansing, scouring, or bleaching silk, woollen, cotton, and other woven fabrics and yarns, and in ageing fabrics and yarns when printed. May 15; six months.

Henry Bessemer, of Baxter-house, Old Saint Pancras-road, engineer, and John Sharp Cromartie Heywood, of Islington, Middlesex, for improvements in expressing and treating oils, and in the manufacture of varnishes, pigments and paints. May 15; six months.

Moses Poole, of London, gent., for improvements in apparatus for drawing fluids from the human or animal body. (Being a communication.) May 15; six months.

Louis Alfred De Chatanvillard, of Rue St. Lazare, France, gent., for improvements in fire arms, cartridges, bullets, bayonets and ordnance. (Being a communication.) May 15; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subject of Design.
May 10	1880	Simon A. Kisch	Maddox-street	Auto-crumatic gown.
11	1881	Richard Waygood	Newington-causeway	Corn and flour grinding and dressing mill.
,,	1882	John Davis Weymouth,	Nailsea, near Bristol	Terrestrial globe.
12	1883	David Harcourt	Bristol-street, Birmingham	Egg blender.
14	1884	John Bourne	Savage-gardens, London	Steamer.
15	1885	William Bishop	Boston, Lincolnshire	Metallic box-end protector.
,,	1886	Henry Knight	Birmingham, engineer	Steam-engine indicator.
16	1887	John James	John-street, Oxford-street	Railway travelling trunk.
,,	1888	Thomas Buckland	Islington	A cigarilla.
,,	1889	John Roberts	Eastcheap, London	Grape tile.

Birkbeck Course of Practical Chemistry.

UNIVERSITY COLLEGE, LONDON. FIFTEEN LESSONS, of two hours each, at a reduced fee, for persons practically engaged in manufactures. Masters of Unendowed Schools and Ushers are admissible to this class. The Course will include the most important ordinary operations of the Laboratory, Chemical Manipulation, Preparation of Gases, Acids, and Salts, with qualitative and quantitative analysis. The instruction will be given by MR. CAMPBELL, demonstrator, under the direction of Professor GRAHAM, on Mondays and Thursdays, from 7 to 9, P.M., commencing on the 17th of May. Fee, including the Cost of Materials, £2.

T. HEWITT KEY, Dean of the Faculty of Arts.
CHARLES C. ATKINSON, Secretary to the Council.

May 5, 1849.

The London Indisputable Life Policy Company.

INCORPORATED BY ACT OF PARLIAMENT.
No. 31, LOMBARD-STREET, LONDON.

TRUSTEES.

J. Campbell Renton, Esq., M.D.
Richard Malins, Esq., Q.C.
Richard Spooner, Esq., M.P.
James Fuller Madox, Esq.
William Wilberforce, Esq.

DIRECTORS.

William Adams, Esq.
John Atkins, Esq.
Henry Augustus Bevan, Esq.
John Dangerfield, Esq.
Robert Henry Forman, Esq.
John Hamilton, Esq.
James Fuller Madox, Esq.
John Matthews, Esq.
Charles O. Parnell, Esq.

AUDITORS.

George Cumming, Esq.
James Turner, Esq.
Samuel Field, Esq.
William Ghrimes Kell, Esq.

MEDICAL ADVISER.

Benjamin Phillips, Esq., F.R.S.

BANKERS.

Messrs. Spooner, Attwood, and Co.

SOLICITORS.

Messrs. Atkins and Andrew.

SECRETARY.

David Alison, Esq.

The POLICIES are INDEFEASIBLE and INDISPUTABLE, which renders them certain as Family provisions, and *negotiable instruments of security* for pecuniary transactions.

To remove all doubt upon this important subject, at present, and for all future time, the following clause has been inserted in the Deed of Incorporation of the Company; Clause 84.

"That every Policy issued by the Company shall be indefeasible and indisputable, and that the fact of issuing the same shall be conclusive evidence of the validity of the Policy, and it shall not be lawful for the Company to delay payment of the money assured thereby on the ground of any error, mistake or omission, however important, made by or on the part of the person or persons effecting such Assurance, and that on the contrary, the amount so assured shall be paid at the time stipulated by the Policy, as if so much error, mistake or omission had been made or discovered."

The whole Profits belonging to the Assured.

ALEXANDER ROBERTSON, Manager.

ALL POLICIES FREE OF STAMP DUTY.

PROFESSIONAL LIFE ASSURANCE COMPANY.—Capital, £250,000, with upwards of 350 Shareholders. Incorporated by Act of Parliament.

In addition to the above, the following advantages are offered to the assured.

All policies once issued, are afterwards indisputable, as appears on the face of the policies.

Rates of premium extremely moderate.

No extra charge for going to or from or residing at (in time of peace) Canada, Nova Scotia, New Brunswick, Australasia, Bermuda, Madeira, Cape of Good Hope, and Prince Edward's Island.

A liberal commission allowed to agents.

Prospectuses with Tables and fullest information may be had at the Company's offices.

Age 20......	£1 10 9	Age 40......	£2 13 6
„ 30......	£1 19 6	„ 50......	£3 18 6

Applications for country agencies requested.

EDWARD BAYLIS, Resident Manager and Actuary.

Offices, 76, Cheapside, London.

NOTICES TO CORRESPONDENTS.

A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the Claims of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d. Post Office Orders to be made payable at the Strand Office, to Joseph Clinton Robertson, of 166, *Fleet-street.*

In our next.—Mr. Gillespie, on the Electric Light; and Mr. Dering on Electric Clocks.

"Tyro" *cannot do better than procure Mr. Tomlinson's "Rudiments of Mechanics," and "Rudiments of Natural Philosophy,"* (*Weale's Series.*)

Nos. 300, 301, 302, *and* 306. *A correspondent will give 2s. 6d. for a copy of each of these Numbers.*

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1346.] SATURDAY, MAY 26, 1849. [Price 3*d*, Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

LESLIE'S REGISTERED CUTTING MACHINE.

Fig. 1.

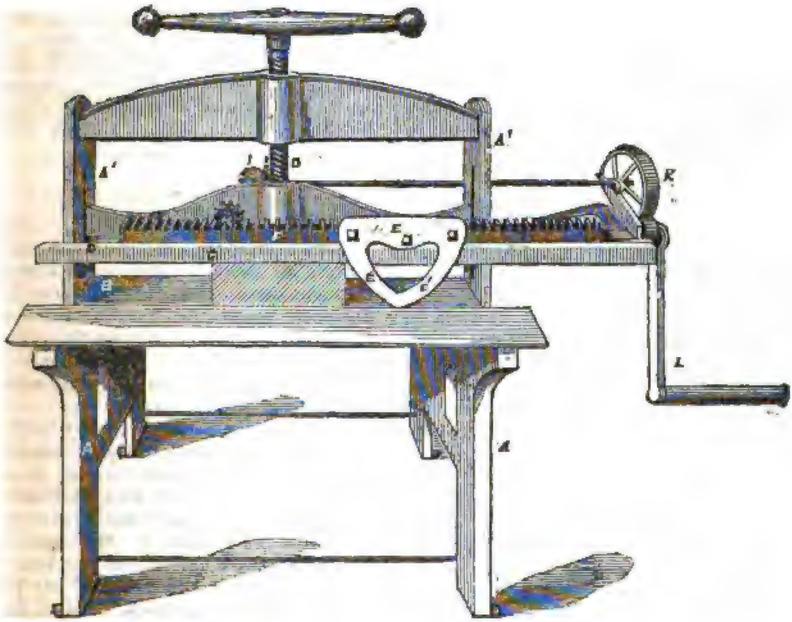
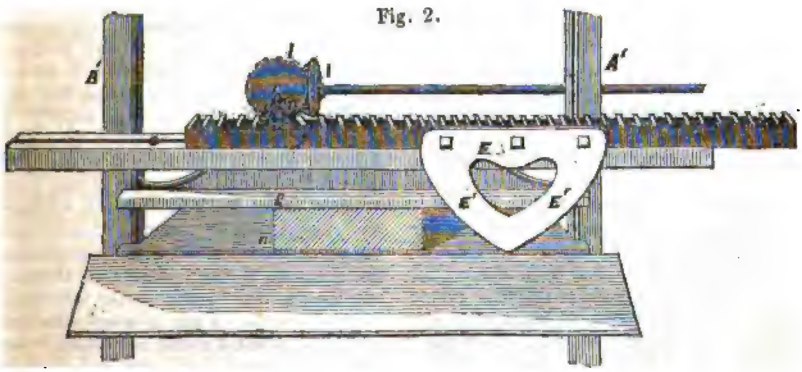


Fig. 2.



LESLIE'S REGISTERED CUTTING MACHINE.

[Registered under the Act for the Protection of Articles of Utility. Robert Leslie, of 35, North Frederick-street, Edinburgh, Proprietor.]

Fig. 1 is a front elevation of this cutting machine; fig. 2 is a separate view of some of the parts detached from the rest. A A, is the framework; B, the bed upon which the paper, millboard, or other substance to be cut, is placed; C is a moveable presser, the ends of which run in slots or grooves formed in the upright standards, A A′, of the framework; D is a screw which works in a nut in the cross-head of the upright standards, A′A′, and serves to hold fast the substance which is being cut between the bed, B, and presser, C; E is the cutter or knife, which has two cutting edges, E′E′, so that it may cut in its passage from right to left, or *vice versâ*—a very valuable feature of this machine, and which constitutes indeed its chief novelty. The knife or cutter is fixed to the side of a rack, F, which is free to slide backward and forward from one side of the machine to the other; for which purpose it is provided with a feather upon its under side, which takes into a groove formed in the cross-piece, G, which constitutes part of the presser. The movements of the rack are affected by the pinion, H (which gears into it), the bevel wheels, I I, the spur wheel and pinion, K K, and the crank-handle, L, which may be turned either by manual or other power.

ELECTRIC CLOCKS.—APPOLD'S ALLEGED IMPROVEMENTS.

Sir,—I shall feel obliged by your sparing me a place in your next Number for a few words in reply to the polite, but uncandid letter of Mr. Appold in your last (page 449). Mr. Holmes, evidently infected with the hostility of his late employers, made a most gratuitous and uncalled for attack on my invention of the electric clock, and sets up Mr. Appold as the perfecter of a previously *imperfect invention!*

The question simply is, have I provided a *governing* and *controlling* apparatus in my electric clocks, or have I not?

There is a quibble in Mr. Appold's statement, that with my plan, "the electric current is on, every second." It is true that the current is on for an instant, every vibration; but the power being always *in one direction*, and the pendulum moving in opposite directions, the influences of these two momentary currents *counteract* and completely *neutralize* each other, and the clock only receives an *impetus* from the electric current *while the pendulum vibrates within the prescribed limits.*

The apparatus I employ for governing and controlling the supply of electric power to my clocks, has been adopted in preference to many other efficient plans which I have devised, on account of its great simplicity and freedom from friction or derangement. It was the objection I had to the introduction of unnecessary complexity, that induced me to decline Mr. Appold's offer of his alleged "important discovery" as *payment for my clock*, being quite convinced that no alteration can be made upon the plan I have adopted, but at the expense of simplicity and fewness of parts, which would entail additional friction.

The excellent going of my electric clock, and the accuracy with which it performed, *as adjusted by me*, is well shown by the fact that, with the disturbing influence of additional power (an extra battery applied by Mr. Appold), it only varied "*one second per hour!*"

Mr. Appold reminds me of my promise to improve his clock. I have, from the first, promised all parties who purchased my electric clocks, that if I made any important improvement, they should have the benefit of it. I have hitherto kept my word, and mean still to do so; for instance, when I introduced the apparatus for regulating the supply of electricity (the very existence of which Messrs. Holmes and Appold would fain deny), I applied it to all the clocks previously, about forty in number, without any charge to their owners. I need not say much in refutation of the ungenerous and groundless attack of Messrs. Holmes and Co., as my electric clocks tell their own tales well. I beg to quote the following unsolicited public testimony, from "Lectures on the Nature and Use of Money," by John Gray, Esq., the

talented author also of "The Social System, a Treatise on the Principles of Exchange."

"When Franklin brought down the lightning by means of a school-boy's toy, and thus demonstrated the possibility of subjugating even the electric fire of heaven to the control of man, is it supposable, that it ever for one instant, crossed his mind, that that very fluid, would eventually become the great channel of instant communication between man and man, residing hundreds of miles asunder?—that it would become part and parcel of the machinery of his own especial trade—that of a printer and disseminator of intelligence? or that it would be the time-keeper of an age to come, performing its work in this capacity, too, with *an exactness leaving nothing to be desired?*"

And then, lest this should be taken for a mere flight of imaginative fancy, the author adds the following note:—"When Mr. Bain, the patentee, first introduced this wonderful invention into the city of Edinburgh, I at once gave him an order for an electric clock, with instructions to make me, if possible, a particularly good one. The accuracy of its time-keeping qualities may be judged of by the fact, that it goes correctly within about five minutes a year; that from the 9th of January to 16th of February, during the present year (1848), it has neither gained nor lost a single second."

I am, Sir, yours, &c.,

ALEX. BAIN.

Beevor Lodge, Hammersmith,
May 15, 1849.

MR. DE LA HAYE'S MARINE LOCOMOTIVE.—EMPLOYMENT OF BALLOONS FOR MILITARY PURPOSES.

Sir,—At page 393 of the current volume, I observe a design for a marine locomotive proposed by Mr. De la Haye, and it appears to me to have that original novelty which most of the schemes of its inventor possess.

Mr. De la Haye, however, has evidently not calculated the dimensions of a vessel constructed upon his plan, and I think that a very rough estimate will be sufficient to indicate how unwieldy such a locomotive would be if it were actually built.

In order to reduce this inconvenient bulk as much as possible, I shall assume—

1. That four cylinders are used instead of spheres—the convexity of the sphere, which never touches the water, being plainly of no use.

2. That the cylinder is immersed to one-half the radius, giving the difference between one-half and one-third in favour of the proposed construction.

3. That each cylinder is intended to float 50 tons, the vessel's entire burden being 200 tons.

4. That the breadth (horizontally) of the cylinder shall be equal to its radius, as these proportions will probably be found the most convenient on the whole.

Proceeding on these assumptions, all of which are favourable to those who may wish to prove the project practicable, it will be found by a simple process (the details of which I need not trouble you with), that the diameter of the cylinder would be more than 100 feet! After this announcement, it will not be necessary to allude to the many other objections to this mode of ship-building. But, nevertheless, there is something philosophical in the conception of this plan, although the proposer of it shows that his appreciation of the principles is very far from being correct. For, in soaring from the sea into the air, he would have us believe that by giving a rotary motion to a balloon, its propulsion would follow as a matter of course.

Now, supposing a balloon *were* made to rotate with any, however great velocity, why should it move *forward* in any particular direction?

Rotating about a vertical axis, and suspended in the air, every circumstance would be precisely symmetrical on every side of that axis, and no motion of the axis could possibly result.

Amongst aspiring aëronauts, there is not a more general or more illusory false notion than one which I have had sometimes to comment upon in your pages, namely, that of reasoning from motion where one element acts upon a body partly supported by another—to motion of a body which, to all intents, becomes a part of the homogeneous medium in which it is to progress. Those who wish to navigate the air must take swimming, not sailing, for their type; and the reckless adoption of a wrong analogy has been the fruitful cause of the numerous absurd propositions which are sure to follow it.

As I am upon the subject of aërostation, I shall add a few words in answer to the questions respecting the employment of balloons for military purposes, which appear in the same Number of your Magazine with Mr. De la Haye's communication. A balloon of the nature required would cost about 200*l.*; but expense would be no object where a battle might be lost or won. Such a balloon could not be raised in stormy

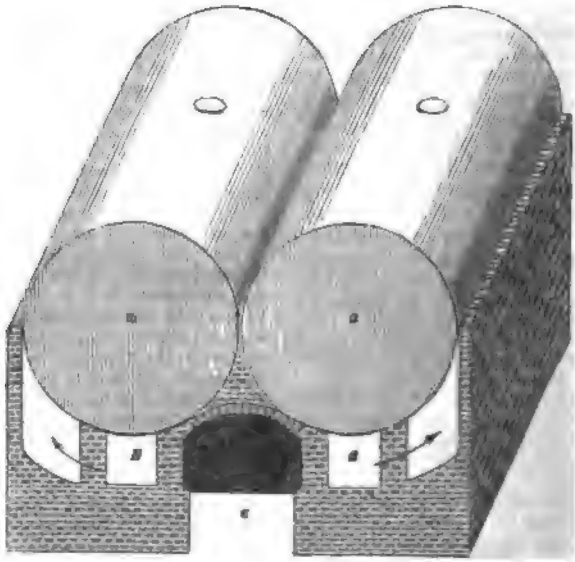
weather: I myself saw one break from its earthly bondage, and spring into the clouds, when the breeze was too strong for those who were employed to confine it. Gas, I think, could be carried in a condensed state, and as labour is always available in a camp, it could be recondensed after having been made use of. A balloon may be filled in a few hours, and, *in calm weather*, could be kept in that state for some days, being capable, at the same time, of following the tardy progress of the heavy baggage of an army. I do not know why balloons have not been more frequently employed for military purposes, unless it be that no necessity has arisen for their use for more than thirty years—as, unhappily, the positions of a hostile force in the now pending campaigns are generally as well known to the engineers of one army as to those of the other. For meteorological purposes, they never can be employed, until the more ponderous requisite—money—is more freely available for the advancement of science. Silk is, undoubtedly, far superior to any other substance yet known as a material for the retention of gas. There is but little weight in the objection that a balloon would offer a mark to the enemy's bomb shells. It would never be required in the active advanced posts of an army, but rather as a distant look-out during a siege or the passage of a river.

I am, Sir, yours, &c.,

JOHN MAC GREGOR.

24, Lincoln's-inn-fields, May 6, 1849.

DESIGN FOR A FURNACE AND BOILER.



Sir,—A new arrangement of furnaces and boilers for steam engines has occurred to me, which seems calculated to combine the utmost strength of boiler with great economy of fuel. The prefixed sketch will, I think, require but little explanation. *a a* are two cylindrical vessels, placed in close proximity side by side, and communicating with each other by steam and water ways, so as to form one boiler; and in the recess space underneath, where the two vessels join, I place the furnace, and such part of the recess as may extend beyond the furnace, serves as a flue to carry the flame to the back or further end of the boiler; where the flue or draught is divided in two, and one part of the heated air returns under one vessel, and the other part under the other, along the flues marked B B, whence it then passes in the direction shown by the arrows, under the outer sides of the boiler, and on to the chimney.

A part of the brickwork is removed in the figure, to show the position of the flues, *c*, in the ash-pit. It will be observed that the furnace and flues traverse the whole length of the boiler three times, and that the boiler is unquestionably well adapted for strength, while it admits of easy access to any portion of the interior part for the removal of slate or incrustations, by which boilers are so liable to be damaged.

I am, Sir, yours, &c.,
URIAH CLARKE.

Leicester, May 1, 1849.

THE ELECTRIC LIGHT—MODE OF ADJUSTING THE CARBON POINTS.

Fig. 3. Fig. 2.

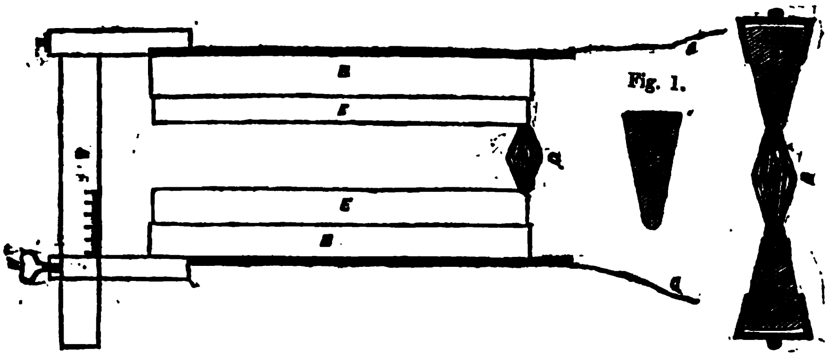


Fig. 1.

Sir,—I beg to submit a plan for overcoming the difficulty experienced by the wasting of the carbon points used in obtaining light from a galvanic current, which occurred to me while attending a lecture on the subject a few evenings since.

The arrangement I propose will enable the operator to maintain nearly an equal intensity of light as long as the quantity of electricity is equally supplied, without personal attendance, or any arrangement of machinery, to keep the carbon within the requisite distance.

What I would suggest is, that the carbon should be either cut or moulded, as shown in fig. 1, and in such lengths as will be proportionate to the required duration of the light, which must be ascertained by experiment. The carbon after being moulded is to be fixed into two pieces of brass or other conducting material shaped as shown by fig. 2, so as to hold it firmly, and at the same time bring a large portion of the surface of the two materials in contact, in order that there may be no obstruction to the current. The pieces of brass where the carbon is inserted are to be fixed either in an upright or horizontal position, at the minimum distance required to produce the lights, and the connection with the galvanic battery to be made by the wires, C C. It is evident that the current will commence at the end nearest to the wires, and as in all cases the current of electricity travels the shortest road from one electrode to the other, it will advance along the parallel lines in the same proportion as the carbon is dissipated, and, of course, the arch of light will accompany it. It is evident, therefore, that the duration of the light is only limited by the length of the pieces of carbon, and by arranging them horizontally there will be no shadow cast beneath. The preparation of the electrode should be carefully attended to, so as to have it as homogeneous as possible in order that it may be equally dissipated at both sides.

The light could be maintained for a long period in a very small space by arranging the materials in a spiral horizontal curve.

The parts marked A are intended to be of some non-conducting substance.

I am not aware whether the same idea has occurred to others before me, and not having heard of it, I thought it would be well to bring it before your talented corre-

spondents and readers, in order that, if it has any merit, it may be developed and made useful; and if not, it may, perchance, induce others to turn their attention to the matter, and be the indirect means of overcoming a great difficulty.

I am, Sir, yours, &c.,
W. GILLESPIE.

Description.

Fig. 1 represents the carbon when moulded.

Fig. 2 shows the confining screws and carbon in their relative positions with the cone of light, D; this figure is a section of the arrangement shown in fig. 3.

Fig. 3, a graduated glass rod, to which one pole is permanently fixed, and the other moveable at pleasure, and confined by a screw, R. B B are the pieces of brass holding the carbons, E E, the brass being made with a spring to retain them. D, cone of light at the commencement, which gradually travels to the opposite direction.

SPEIRS'S REGISTERED HYDRANT OR WATER VALVE.

[Registered under the Act for the Protection of Articles of Utility. Alexander Speirs, of the Vauxhall Foundry, Liverpool, Inventor.]

Fig. 1.

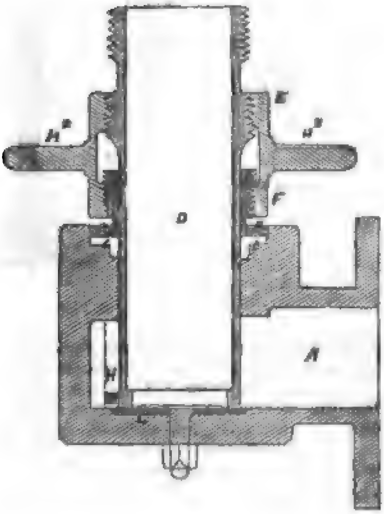


Fig. 2.

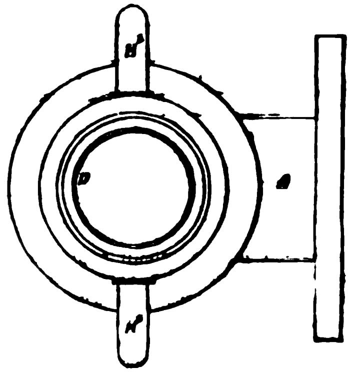


Fig. 1, is a sectional elevation of this hydrant; and fig. 2, a top plan. The body of it is made of cast-iron. A, is a pipe which projects from one side, and is provided with a flange, by which it is connected to the water main. At right angles to the pipe, A, there is an opening made in the hydrant, into which there is screwed a short brass tube or bush, B. C, is a washer or packing of gutta percha or leather, which forms a seat for the bush, B; D, is a pipe which is passed within the bush, B, and packing, C, and extends right across the pipe, A. At its inner end, this pipe is faced to fit exactly a packing, G, of gutta percha or leather; and when pressed up against the packing, it is kept from shifting round by a projecting feather, H, which works in a groove made for it on the inside of the hydrant. H², is a screw hand coupling provided with two opposite threaded screws, one of which, E (the right-handed one), takes into a thread formed on the outside of the outer end of the pipe, D; and the other, F (the left-handed one), into a thread formed on the outside of the projecting part of the bush, B. According as the coupling is turned to one hand or the other, the pipe, D, is raised or lowered, and the water admitted or shut off. At its extreme end, the pipe, D, is screwed for the purpose of connecting a hose-pipe to it.

DAVIES'S ROTARY ENGINE.

Sir,—I must again request a small space in your columns for a reply to Mr. Dredge's letter, which appeared in the *Mech. Mag.*, of the 19th inst.

I thought I had expressed my meaning clearly at the outset; but as Mr. Dredge appeared to have misunderstood me, I gave an explanation of the passage in my last letter: I am doubtful, however, whether he accepts the explanation, or whether he regards me "so ignorant as not to know that, for the equalization of power, the fly-wheel is requisite throughout the revolution?" I therefore feel called upon to say a few more words upon the point. I am well aware that in most engines a fly-wheel is requisite to render the motion uniform and equable; but in the passage which "startled" Mr. Dredge, and in the subsequent explanation of it, I was merely considering to what extent the fly-wheel is necessary to overcome the dead point in the two classes of engines, and thereby to complete the rotary motion, but without regard to the *uniformity* of the motion; and I showed that, whilst for this purpose the fly-wheel is requisite during only $\frac{1}{15}$th part of the stroke in a reciprocating engine, the rotary engine requires its aid through $\frac{1}{3}$rd of its stroke or revolution to carry it past the line of centres. Mr. Dredge objects to this, that even if my data were admitted, my conclusions are erroneous, inasmuch as the reciprocating engine is twice on the line of centres in each revolution, whilst the rotary engine is so only once; but if we suppose the engine to have two pistons to each cylinder (which constitutes one of the latest improvements), it will be seen that both the parts are closed twice during each revolution, and therefore my calculation is correct.

If we proceed to consider the fly-wheel as a regulator, serving to render the rotary motion equable or uniform, we shall find a more powerful fly is required for the rotary engine than for the reciprocating engine, owing to the greater fluctuations of the impelling force in the former. In the reciprocating engine, the steam acts upon the piston throughout the stroke, either with uniform pressure or expansively towards the close of the stroke, so that the variations in the impelling force are not sudden, but gradual. In the rotary engine, on the contrary, the steam may be said to act percussively—it is admitted to the piston during only one-third of each semi-revolution or half stroke, and is then suddenly shut off; but instead of being allowed to act expansively upon the piston during the remaining two-thirds of its course, as would be the case in a reciprocating engine, its further action is instantly annulled by the pressure upon the opposite sides of the piston being equalized, and the piston is carried onwards through the remaining two-thirds of its semi-revolution solely by the momentum of the fly-wheel. A very powerful fly, it is evident, will be requisite to regulate such great and sudden variations of the impelling force.

As to the question of cost, Mr. Dredge having first noticed it, I was certainly at liberty to advert to it; and, be the additional expense little or much which is occasioned by the employment of two cylinders for the purpose of avoiding the dead points (which, in a rotary engine, should be unnecessary), it is clear that the increased weight and dimensions of the engine thus constructed, have no tendency to increase its efficiency, but, on the contrary, in many situations, would constitute positive objections. The additional expense, therefore, is simply the price of an imperfection.

In the concluding paragraph, Mr. Dredge again contends that there are no dead points in the engine, because he persists in considering what he describes to be *a combination of two engines* as one engine. I will not, however, go over my former arguments on this head, but will meet Mr. Dredge on his own ground; and I therefore assert, and am prepared to show, that even in the *combined engines*, there are dead points, at which the steam exerts no power to impel the pistons. This may, at first, "startle" Mr. Dredge; but if he will carefully investigate the subject, he will, I have no doubt, find that such is the case. I shall not, therefore, unless called upon to do so, trespass upon your columns with the proof.

I am, Sir, yours, &c.,

A. Z.

May 22, 1849.

ARRANGEMENTS FOR GIVING UNIFORMITY OF ACTION TO ELECTRIC CLOCKS AND TELEGRAPHS.

Sir,—As the continual variation of the strength of the galvanic current, whether derived from "earth batteries," or from any of the various other forms, appears to be the chief impediment to the success of electric clocks as perfect time-keepers, I shall feel obliged by your affording me space to describe a principle upon which I have for some time been intending to construct one, with a view to rendering the power by which the pendulum is kept in motion *always uniform*, and not variable, as at present, according to the force exerted by the battery. It will be seen that, except it fall below a certain known limit, all variations in the battery power, such as those

caused by the addition of fresh acid, and the gradual decline of its strength as it becomes saturated with the salts of the metals used; or by a change of batteries from a weak to a powerful one, or the reverse; or by the varying moisture of the earth in cases where earth batteries are employed—will be compensated for by this arrangement, with the greatest certainty and exactness.

Figs. 1^a and 1^b represent respectively a front view and ground plan of the pendulum and electro-magnetic arrangement; and fig. 1^c a section through the line xy of fig. 1^b. a and a' are two flat circular coils of wire through which the current is made to pass, as shown by the arrows being conducted up and down the *wooden* pendulum-rod, B, by the wires, t, through the reversing apparatus above, which is omitted in the figure for the sake of distinctness. These coils are both wound in the same direction, and are acted upon when the current is passing by the compound horse-shoe magnets, N S, N S. C, is an adjustable weight, answering to the usual "pendulum-bob."

Fig. 1^b.

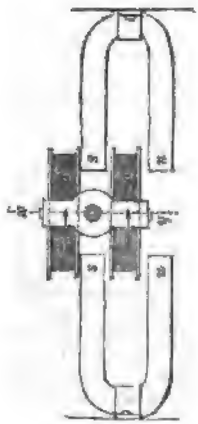


Fig. 2^a.

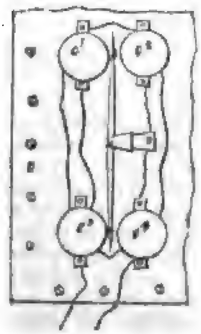


Fig. 1^a.

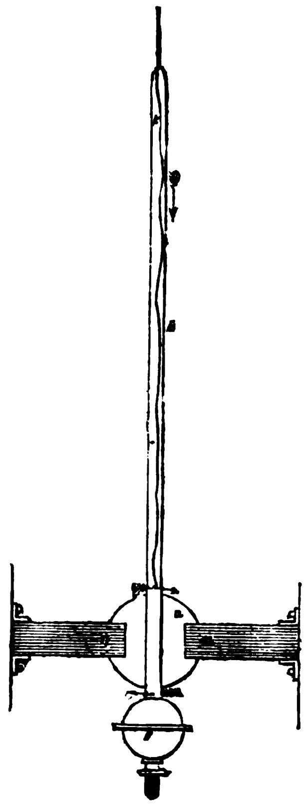


Fig. 1^c.

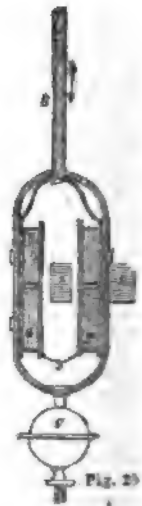
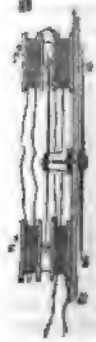


Fig. 2^b



The means by which the compensation is effected will now be easily understood; for it is obvious that if the coil, a', were removed, the magnets would act with their whole force upon the other coil; and according as the power of the current passing were greater or less, so would the force acting upon the pendulum be increased or diminished, and a consequent irregularity in its motion produced; but by the addition of the coil, a', upon which the magnets act with *one*

half the power, but in the *reverse* direction, a constantly uniform motion s insured. For, supposing that the strength of the galvanic current, and consequently the force exerted upon the coil or wire were suddenly doubled, not the slightest alteration in the motion of the pendulum would ensue, any more than an alternation would be produced, if an exactly equal weight (say of 1 lb.) were added to each end of a lever, for the retarding action of the coil, *a′*, would be in exactly the same ratio increased.

The effect of variations of temperature upon the pendulum would be counteracted if a vessel of mercury, of properly calculated size, were substituted for the weight, C, as in Graham's compensation pendulum.

The same principle might be, with great advantage, applied to the electric telegraph. The movement of the needles against the "stops" would then be always uniform in power, independently of any variations in the strength of the batteries, the insulation of the wires, &c. The uncertainty in reading the signals, which is now occasioned by the needles rebounding from one stop to the other upon any augmentation of the power of the galvanic currents, or by its failing to touch them if the signals are given too rapidly, when it declines, would thus be entirely removed.

Figs. 2^a and 2^b, represent one of the numerous plans by which this may be effected. They show it as applied to an improved arrangement for giving motion to the needles.

In fig. 2^a, the coils, &c., are seen as they would appear at the back of the instrument, being attached to the dial-plate, D. Fig. 2^b is a sectional side-view of the same. It will be seen that the coils are eight in number; the four which are placed between the estatic needles, *s n*, *n s*, act in such a manner as to deflect them in either direction, when the current is passing, according to the connections; the whole force of the current is thus made to act upon their extreme poles, and the loss of power occasioned by its passage through an unnecessarily long coil is avoided. The supplementary coils, C^1, C^2, C^3, C^4, being placed behind the inner needle, act with one half the power of the others, but in the reverse direction (in the same manner as the coil, *a′*, in the clock before described), the force with which the needles are moved is thus always uniform.

It appears to me that by the adoption of these arrangements, the inaccuracies I have alluded to in the action of the electric clock, and the uncertainty in the action of the telegraph, would be entirely prevented.

I am, Sir, yours, &c.,
GEORGE E. DERING.

May 9, 1849.

THE CASE OF THE FRACTURED CRANES.

Sir,—Mr. Terence Smith's contributions to the pages of the *Mechanics' Magazine* are always interesting, and exhibit much scientific inquiry and research. His last paper, page 422, is particularly so. Failure is frequently more instructive than success, and its record of more practical advantage. It is this which renders Mr. Smith's paper so very interesting.

I am inclined to attribute the failures of the cranes in question to the irregular contraction of the metal when cooling; for, in castings with a variety of section, the parts where the metal is slightest cool first, and then have to sustain the almost irresistible contracting force produced by the larger section of the metal, which cools more slowly, and which thus frequently strains the lesser section to an extent almost bordering on rupture.

Thus, suppose the hollow cylinder where the fracture took place to possess a less transverse sectional area, as compared with its superficial area, than the flange supporting the gib, the cylinder would, in consequence, cool before the heavy mass of metal composing the flange; and when we remember that a difference in temperature of 200° is equivalent to a strain of 10 tons per square inch, it it not so much a matter of astonishment that the cranes gave way, even though the test weight were less than the value indicated by the table of transverse strength.

It must be borne in mind that the experiments from which the tables of the strength of materials are computed, were made with prisms of uniform texture, and for prismatic bodies they may, no doubt, be depended on; but cast iron possessing any variety of section, which offers an irregularity of the contracting force in cooling, should, if subjected to any strain, be always closely watched and carefully guarded against.

I am, Sir, yours, &c.,
WILLIAM DREDGE.

London, 10, Norfolk-street, Strand, May 16, 1849.

TIBBITT'S PATENT ROTARY ENGINE.

(*See ante, p.* 428.)

Fig. 1.

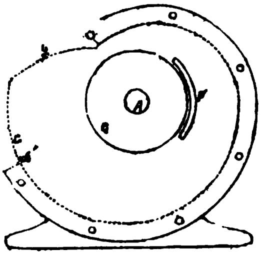


Fig. 3.

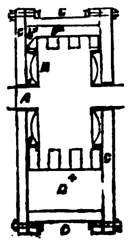


Fig. 2.

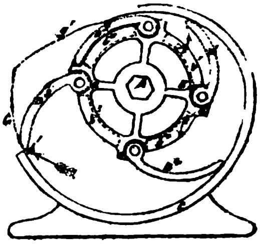


Fig. 4.

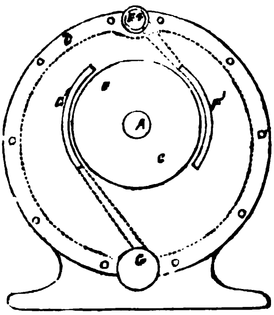


Fig. 6.

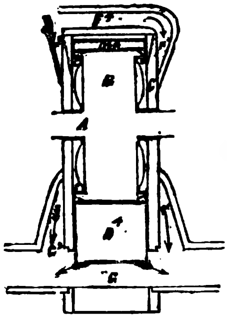
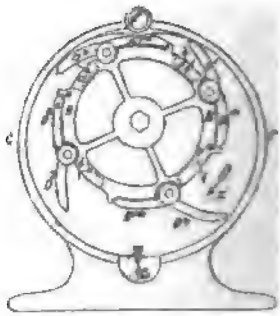


Fig. 5.



Figs. 1, 2, and 3 of the annexed engravings represent a single-acting rotary engine on Mr. Tibbit's plan; and figs. 4, 5, and 6, a double acting one—those parts only of each engine being shown which are necessary to a proper understanding of its peculiarities. Figs. 1 and 2 are transverse sections, and fig. 3 a side section of the single-acting engine. A is an axis, on which is mounted a cylinder, B, which rotates within a fixed outer case, C, of the peculiar eccentric form shown. D^1, D^2, D^3, D^4, are four leaves or pistons, which are hinged or jointed to four ribs, *a*, *a*, *a*, *a*, raised on the outside of the cylinder, B. F is an induction passage for the steam, and G the eduction passage. Each quarter of the cylinder, B, is bevelled off towards the outside at the parts b^1, b^2, b^3, b^4, so that as these parts come successively over the induction passage, F, the steam may have free access under the leaves or pistons, D^1, D^2, D^3, D^4, but be shut off as soon as they have completed their transit. The action of the engine is as follows:—Supposing steam to be admitted at b^1, when the pistons are in the relative positions shown in fig. 2, it will force the piston, D^1, outwards against the inner circumference of the case, and, pressing against the ribs to which that piston is attached, impart a rotary motion to the cylinder, B. As the cylinder advances in its rotary course, the unbevelled part behind b^1 comes over the induction passage, F, and shuts off any further supply of steam to the space behind the piston. D^1; but the steam which has been previously admitted into the said space acts expansively throughout the remainder of the stroke of that piston, which terminates as soon as it reaches the point d^1, when the steam escapes into the eduction passage, G, whereupon the piston is gradually forced by the guide, *g*, to recede inwards into the hollow space between the rib to which it is attached and the next succeeding rib, and becomes flush with the two ribs, as shown in fig. 2, in which state it remains until it again comes over the

induction port. The same course of action takes place with each of the pistons in succession, and so on continuously as long as steam is supplied. The ribs and pistons come into close contact with the upper part of the case as the cylinder revolves (being ground to fit one another truly), which makes the engine steam-tight at that point.

In figs. 4, 5, and 6, which represent a double-acting engine on the same plan of construction, the parts are precisely the same as before described, with this exception, that there are two sets of leaves or pistons, D^1, D^2, D^3, D^4, and $D^{1a}, D^{2a}, D^{3a}, D^{4a}$, hinged or jointed in pairs on to the outside of the cylinder, which cylinder is bevelled off, as before described, on one side, to admit steam under one set of pistons, and on the opposite side for the others. The set, D^1, D^2, D^3, D^4, are represented as being in action, and the engine as going in the direction indicated by the arrow, *s*. Steam is admitted by the induction port, F^1, and escapes by the eduction ports, G and G^1. When the engine is required to be reversed, steam is admitted at the opposite end of the cylinder by the port, F^2, and escapes by G and G^2, when the set of leaves, D^1, D^2, D^3, D^4, cease to act, and $D^{1a}, D^{2a}, D^{3a}, D^{4a}$ are brought into action.

INSTITUTION OF MECHANICAL ENGINEERS.

Quarterly General Meeting, April 25, 1849.

Robert Stephenson, Esq., M.P., President of the Institution, in the Chair.

[The present was the first meeting of this Institution, since the election of Mr. Robert Stephenson to succeed his lamented father in the Presidency; and excited therefore a more than ordinary degree of interest. We subjoin the official report of Mr. Stephenson's Inaugural Address, and also the official minutes of some of the more interesting papers read on the occasion—for copies of both of which we are indebted to the courtesy of the Council.

We regret to observe the desponding—nay, almost despairing tone in which the President—speaks of the prospects of the Institution, and observe also with some surprise that he regards it as but an illustrative instance of a prevailing "languidness and inactivity in the pursuit of those arts and sciences on which the nation's wealth absolutely depends!" We have no right to question the correctness of the representation which the worthy President makes of the condition of his own institution; but we must take leave to say, that he ascribes it to a state of feeling in the public at large, which exists only in his own imagination, and is in direct contradiction to a thousand notorious facts. Mr. Stephenson himself refutes his own assertion when he afterwards observes that the nation stands "preeminent for mechanical abilities"—that "all foreigners concede to us an unmeasured preeminence in those particulars (*i. e.*, the mechanical) arts." Such preeminence, and such "languidness and inactivity" are things which could evidently not coexist. If institutions for the promotion of the mechanical arts have not thriven as the arts themselves have thriven, and as they ought naturally to do, we may be perfectly sure that it can only have arisen, from something faulty either in their organisation or their management. Let us test the truth of this by the case immediately before us. Who can wonder at want of success, attending such a state of things as is disclosed by the earnest call which the President makes on the members, to be up and doing—to put their own shoulders to the wheel. "He wished strongly to impress upon them that without energy and industry they must fail *as heretofore*. He would endeavour to do his part, and trusted and hoped most sincerely that the members would not fail in doing theirs, *for without their assistance* no efforts of his would sustain an institution of that kind." It is of no use certainly for people to form institutions unless they will turn them to some account; it is literally associating—to do nothing. To be a member of such a body is simply to be one of a number of cyphers—to be of the Council, to be only a bigger cypher than the rest. Another circumstance which has had, no doubt, an unfavourable influence on the progress of this particular institution, and would have had under any circumstances, is its very indefinite character—on which point we took occasion to make a remark or two at the time of its commencement (see vol. xlvi., p. 520.) What is a *Mechanical Engineer* as distinguished from a *Civil Engineer?* And what are the topics which it would be proper to discuss at the *Civil* Engineers' Institution in London, but which would be out of place at the *Mechanical Engineers'* in Birmingham? No one can tell. The Institution goes by a name which neither indicates clearly the class of persons of whom the Institution is composed, nor conveys any distinct notion of the range of subjects, with which they occupy themselves, or would like to be thought occupied. The founders of the institution would seem to have had in their minds, some confused idea, of there being a line of demarcation to be drawn, between those who design and build engines and machines only, and those who design, and (by means of such engines or machines) construct those greater affairs which go commonly by the name of Public Works, as harbours, bridges, canals, railways, &c. No doubt there is such a line, and a very broad one too; neither ought it to have been a difficult matter to find out a name which would have characterized those on the one side of the line, as clearly as the word "Civil" does those on

the other. Indeed popular usage had already coined a name for the purpose, which only required authoritative adoption by such an institution as this, to have become permanently engrafted on the language. Every one understands what is meant by a *Manufacturing* Engineer, as distinguished from a "*Civil*;" and if our Birmingham friends had but assumed the style and title of THE INSTITUTION OF MANUFACTURING ENGINEERS, they would at once have cleared away all doubt about their status, and objects, and multiplied their chances of success tenfold. Perhaps it may not even now be too late to profit by the suggestion. As the opportunity offers, we may mention two other circumstances which, we fear, have not been without their share of influence in producing that generally unsatisfactory result which the President so unaffectedly deplores. The entrance fee and annual subscription are complained of as being too high (considering the ben fits conferred,) and the periodical meetings as being too few—once a quarter only. The former might, we fancy, be reduced one-half, and the latter increased to once a week with real advantage both to the finances and to the usefulness of the Institution.—ED. M. M.]

The President's Address.

The CHAIRMAN rose and said, the members must permit him to open the proceedings of the meeting by tendering to them his sincere thanks for the distinguished privilege they had conferred upon him, by electing him the President of the Institution of Mechanical Engineers. He assured them that he highly prized it, and would endeavour to prove himself worthy of it by attending with diligence and energy to the interests of the institution. In undertaking that duty, it was not merely because he delighted in mechanical pursuits, but he was actuated also by the feeling that he should be doing honour to the departed. In undertaking it, however, it was necessary that he should express to them how apprehensive he was—at least, that he had apprehensions —of an institution of that kind failing for want of energy on the part of its members. What had hitherto been the character of almost every institution of this kind in this country? almost universal failure. It was a remarkable circumstance, that in a country like Great Britain, whose wealth and power are so closely connected with the development of the mechanical arts and sciences—it appears to him, in fact, a complete anomaly — that institutions of that kind should not appear to reach a higher standard than they now had. They saw astronomers cultivate and maintain a society for extending their knowledge of the movements of the heavens. They saw geologists maintaining and extending societies for investigating and developing the structure of the earth. They saw physiologists and botanists maintaining and extending their societies for investigating and developing the knowledge of the animal and vegetable productions of the earth: yet they had witnessed only languidness and inactivity in the pursuit of those arts and sciences on which the nation's wealth absolutely depended. That it shoud be the case was to him the more remarkable, because the nation stood pre-eminent for their mechanical abilities. It was not egotistical in him to say this in Britain, because all foreigners conceded to them an unmeasured pre-eminence in those particular arts. Without despairing, therefore, of the success of the institution, he felt that in undertaking the task he was now doing, it was necessary that he should impress upon the members the absolute necessity of co-operating with him with energy in the further development of the institution. With that stong conviction on his mind, he wished also strongly to impress it on them; for without energy and industry they must fail as heretofore. He would endeavour to do his part, and trusted and hoped most sincerely that the members would not fail in doing theirs, for without their assistance no efforts of his would sustain an institution of that kind.

Minutes of Proceedings.

Mr. BAINES exhibited and explained some specimens of his *Patent Railway Chairs and Switches*. Of the chairs, one was a joint chair, the other an intermediate one.

The joint chair had one jaw on the outer side, fitting close up to the head of the rails, and the rails were fixed by a horizontal dowel-pin, 1¾ inch wide and seven-eighths of an inch thick, which was passed through a notch in the end of each rail, and a corresponding hole in the outer jaw of the chair, and was drawn up by a vertical cotter driven through the dowel-pin on the other side of the chair. A wrought iron plate, 9 inches long, was placed under the head of the dowel-pin, fitting close up to the head of the rails on the inner side, and this plate was drawn up tight against the rails by driving the vertical cotter, and forming a stiff scarfing piece across the joint of the rails; this plate was a little cambered, and was sprung flat by driving the cotter.

The intermediate chair was intended to hold the rail without the use of a key; the two jaws were of the same form, both fitting up close to the head of the rail, but they were placed obliquely instead of opposite to each other; the chair was slipped endwise on to the rail, and then twisted at right angles to the rail, which made it grip the

rail between the two oblique jaws. The chair was forced tight against the rail, either by screwed spikes with conical heads and eccentric countersink holes in the chair, which forced the chair further round and increased the pressure of the jaws on the rail, when the conical head of each screw was drawn home into the countersink; or another plan for doing the same thing was by using square spikes tapered to a greater breadth at the upper part where they passed through the chair, so that by driving them down, the chair was forced further round against the rail.

An estimate was presented of the comparative expense of laying a railway on the above plan and on the ordinary plan, and the following were the respective amounts stated in it; the amount in each case including only the cost of the chairs, keys, and spikes, as the rest would be the same in each case.

	£.
The cost for a mile of single way, laid on the ordinary plan, with wood keys and iron spikes	348
The cost for a mile of single way, laid on the above plan, with square taper spikes	340
The same, with screwed spikes . . .	363

but the square taper spikes were considered equally efficient, and they were more convenient than the screwed spikes for drawing out in repairs, &c., as well as less expensive.

The Chairman asked what trial had been made of these chairs?

Mr. Baines said the only trial that had yet been made of them was a short length of line at the entrance of Norwich Station, which had been at work with these chairs for eleven months with complete success, and had not required any repair of the chairs. It was situated where all the trains ran over in entering the station.

The Chairman remarked that it was important for a trial to be made on a main line where the trains were passing at full speed, because any iron fastenings of that kind was liable to be affected by the speed of the trains. He asked whether the keys had ever got loose at all in the trial that had been made?

Mr. Baines said a trial of the Joint and Intermediate chairs would be made shortly on the main line of the North Staffordshire Railway, at Danes Moss, near Burton. In the trial already made of them at Norwich, there had not been any looseness of the keys of the joint chairs, and they remained just the same as when first put down. He had made a trial of the joint chair by removing the whole of the ballast away from under the joint sleeper, and the joint chair held the rail ends so firmly, that scarcely any deflection could be perceived when an engine passed over. He thought these chairs would do away with the canting of the joint sleepers, and would prevent a great deal of the noise in passing over the joints.

Mr. M'Connell suggested that it would be preferable to make the dowel-pin with rounded edges, and the notches in the rail ends similarly rounded at the bottom, for the purpose of preventing any risk of the rails splitting from the angles of the notch.

Mr. Baines said he did not see any objection to the proposal; but he thought there was not any risk of the rails splitting from the notch, because a clearance of $\frac{1}{8}$th inch was left between the dowel-pin and the top of the notch, so as to prevent any pressure ever coming upon the dowel-pin. The joint chair formed a coupling between the rail ends, and the rails supported one another.

The Chairman observed, that if this joint chair stood the test of the working on a main line, it would be the thing desired, but he feared there were too many parts about it to stand well. He considered the construction of some secure fastening for railway chairs was of the last importance for railways, and thought the subject well deserving the attention of the members; it was desirable to have as few parts as possible, and those not very costly.

Mr. Woodhouse asked how it was intended to replace a chair becoming loose or breaking; whether the rail would have to be taken out for the purpose?

Mr. Baines said he proposed having some chairs cast wider in the jaws, which would allow them to be slipped on to the rail from the under side, for the purpose of replacing any broken chairs without taking out the rail. But he fully expected there would be very little breakage of the chairs, because there were no keys driven into them, and a great proportion of the breakage of the ordinary chairs was caused by driving the keys; also the new chairs were made stronger than usual; he had tried one of the intermediate chairs by suspending it from one of the jaws, and hanging a weight of $10\frac{1}{4}$ tons from the other jaw for several weeks, and there was no failure in it.

Mr. Baines then explained the switch, the principal improvement in it being the additional depth of the switch tongue, which was made about an inch deeper than the main rail, and the bottom flanch of the switch tongue worked under the main rail when the switch was shut; for the purpose of driving under the main rail all the dirt that got between them in the working of the switch, instead of driving the dirt against

the main rail, which was an evil in the ordinary switches, where the rails were all of the same depth, and caused the risk of accident by the switch being prevented from closing properly. Another advantage obtained from this construction was, that the bottom flanch of the switch was kept entire to the end, instead of being planed off on one side, as in the ordinary switches, and that increased the steadiness and strength of the switch tongue.

The Chairman remarked, that the switch tongue was chamfered equally on both sides.

Mr. Baines explained that the tongue was formed according to Mr. Wild's plan, with the point dropping under the head of the main rail; and the tongue was shaped exactly the same on both sides, so that the switch could be used either right or left-handed.

The Chairman thought that was an improvement.

The Secretary next read a *Description*, by Mr. Weallens, of Newcastle, of an *Express Engine* manufactured by Messrs. Robert Stephenson and Co., for the York, Newcastle, and Berwick Railway, in 1848, and intended to run the express trains between Newcastle and York, a distance of 83 miles, as soon as the relaying of that line, which is now in progress, is completed.

This engine has inside cylinders with a crank axle; and six wheels, inside bearings for the crank axle, and outside bearings for the leading and trailing axles.

The cylinders are 16 inches diameter, and 20 inches length of stroke. The valves are vertical, and are placed on the outer side of each cylinder, instead of the inner side; the exhaust passages are carried under the cylinders, and unite at the blast pipe. The steam ports are 1½ inches wide by 13 inches long, and the exhaust ports 2½ inches by 13 inches; the traverse of the slide valves is 4½ inches. The eccentrics are fixed on the ends of the crank axle outside of the wheels, and the valves are worked by the expansion link motion. The pumps are worked by the same eccentrics, and are fixed at the sides of the fire-box. The boiler is 3 feet 10 inches diameter, and 11 feet in length, containing 174 tubes of 1⅞ inches outside diameter, and 11 feet 5 inches length. The inside fire-box is 3 feet 9 inches long, by 3 feet 8 inches wide, and 4 feet 9 inches high from the top of the fire-bars to the underside of the roof.

The heating surface in the fire-box is		82	square feet.
Ditto	ditto tubes	964	„
Total heating surface		1046	„

The driving wheels are 6 feet 6 inches diameter, and the leading and trailing wheels are 3 feet 9 inches diameter.

The outside and inside framings consist each of a single flat wrought iron plate, 1 inch thick and 8 inches deep; the inside frame is bolted to a flanch upon the cylinder and to a bracket on the fire-box; the outside frame is bolted to a flanch upon the steam chest, which is in one casting with the cylinder, and is attached to the boiler by three wrought iron brackets on each side.

The weight of the engine in working trim is about 22 tons.

The description, of which the above is an abstract, was accompanied with five sheets of illustrative drawings.

The Chairman observed that this engine did not differ materially from the ordinary express engines, except that the steam chests were brought outside, and the eccentrics placed outside the driving wheels. He might state that he had seen the engine, and the consumption of coke, including getting up the steam, was 18 lbs. per mile with the express trains, which were generally very small, having only three or four carriages.

Mr. Mc Connell remarked that the distance from the valves to the cylinders was longer than usual, and would be a little loss in steam; otherwise, in several respects, it was a convenient arrangement.

Mr. Beyer thought the parts got more spread by that arrangement.

Mr. Mc Connell observed that it appeared to be the intention to lower the centre of gravity, by removing the eccentrics from under the boiler; there would be an advantage in the valve faces being very easy to get at for repairs, in consequence of being placed outside.

Mr. Henry Smith, of West Bromwich, next read a paper on *A Patent Solid Wrought Iron Wheel* of his invention. The wheel is forged solid in one piece, and is manufactured entirely by the forge hammer; it is disc-shaped, the disc portion being about ⅝ inch thick, and gradually swelled out to the thickness of the nave and the tyre.

The following were stated to be the chief desiderata in a railway wheel.

1. The greatest possible strength with the least possible weight.
2. Durability, implying also facility of repair.
3. Economy in cost.

On the first of these points it is conceived there will be no difference of opinion about the disc shape being the strongest possible; and also that when a wheel is made in one entire piece, it must necessarily be less liable to the effects of wear and tear, than one which is composed of a number of pieces. This will be made more manifest by analysing the mode of manufacturing railway wheels in the old or ordinary way. For this purpose, and for the sake of drawing the fairest comparison between the wheel now under consideration and the ordinary wheels, a wrought iron wheel is selected of the most improved make, having a wrought iron nave, with the spokes welded to the nave and to the inner tyre.

The following is the mode of manufacture of this latter wheel. Pieces of iron, with wedge-shaped ends, are brought together all converging to a common centre. These are then welded together to form the nave or boss and the inner ends of the spokes, of the intended wheel. Other pieces, T-shaped, are then welded to the ends of these spokes, and again to each other, forming the inner tyre of the wheel. This done, a rolled tyre-bar of a suitable length, is bended into a circle of a proper diameter to go on the inner tyre, and is welded to form a perfect circular hoop. This hoop is then heated in a furnace, and put upon the inner tyre, and then the wheel is immersed in cold water to occasion such an amount of contraction of the tyre as shall firmly fix it upon the wheel. Rivets or bolts are then passed through both, to secure them together.

Now, it was submitted that the whole process of thus producing a wheel is open to many well-founded objections, such as the following:—

The possibility of a want of dexterity in the manipulation of the different parts, in the making and bringing them together. The chance of doing so when the iron is not in a proper condition for welding; then the uncertainty of the hoops or tyres being exactly the same length, or the wheels with the inner tyre of precisely the same diameter; and again, the amount of contraction of the outer tyre depending upon its slow or rapid cooling, will be affected by any variation in the temperature of the wheel itself and the water in the "bosh" or cooling cistern, and these, of course, cannot be kept uniform. All these circumstances are opposed to wheels being well made with *loose* tyres, whether with wrought iron naves and arms or with cast iron naves.

In reference to the second head—durability, it is conceived from the contingencies already alluded to, that it must be obvious, a wheel made in one piece will be the more lasting; but on this point, the wheel which forms the subject of the present inquiry has other claims to prefer.

In consequence of the iron in the wheel being both granular and laminar, inasmuch as by the mode of manufacture hereafter explained, this result is ensured, and the grain of the iron being brought to stand at right angles to the direction of the wear, and the body of the iron being of a denser and more compact character than rolled iron, it must doubtless be much stronger and more durable than any rolled tyre-bar of piled iron, which is liable to lamination, and altogether of a softer nature.

Again, the torsive and abrasive effects of the carriage-breaks will not produce the same results on a solid disc wheel as on one with a loose hoop or tyre of rolled iron.

Then as regards repairing, when the tyre of the disc wheel is worn down so much as to require a renewal, the wheel can be put in the lathe and turned cylindrical, to receive a tyre in the ordinary way, secured on by bolts screwed into the tyre from the inner side, or by countersunk rivets through the tyre; and it must be then a better wheel than any yet manufactured.

On the subject of cost, it can only be observed at present, that as the first expense does not determine this point, it must be left to be settled by the results of a sufficient experience.

The following is a description of the mode of manufacturing the new solid disc wheels. In the first place, a straight bar of hammered or rolled iron is taken, of 4 or 4½ inches width, or more if required, and sufficiently long to form a hoop of such a diameter as is most suitable to make the intended wheel. Other pieces of bar iron are then laid flat and close together, and cut in lengths to the same circle as the hoop, to form the base of a "pile;" the hoop is then placed upon this foundation, and filled with scrap iron. The whole is then put into a reverberatory or heating furnace, and when at the proper heat, is hammered in the tools or dies, to form a "mould;" the face of the hammer is recessed in such a shape as to form an approximation to the shape of one side of the intended wheel, but only about two-thirds of the diameter; and the anvil face has a circular recess flat-bottomed, into which the hammer face enters. Two of these "moulds" are then put together back to back, heated in a similar way, and hammered between the tools or dies, which are of the same sectional form and nearly the full-size scale of the finished wheel; but these tools embrace only a segment of about one-fifth part of the entire wheel. The "mould" is turned round horizontally

during this process, being turned a little between each blow of the hammer, and it is thus hammered out to the form and size of the required wheel. The wheel is then put into an annealing furnace, and is planished between tools similar to the last, which are of the form and the full-size scale of the finished wheel, and the wheel then only requires the tyre and the nave turning in a lathe, and the centre boring out.

(*To be continued.*)

HJORTH'S MAGNETIC ENGINE.

(*From a Correspondent.*)

Sir Isaac Newton once met Bentley accidentally in London, and asked him what philosophical pursuits were going on at Cambridge? "None," replied Bentley; "for you kill all the game: you leave us nothing to pursue!" "Not so!" said Newton; "you may start game in every bush if you will but beat for it." With this anecdote we have thought proper to head our description of one of the most important discoveries of the century. We allude to the invention of Mr. Hjorth, a native of Denmark,* who has discovered the means of adapting magnetism to all the purposes to which steam has hitherto been applied.

The principle of the discovery is simply this—that any length of stroke by direct pull, either *horizontally* or *vertically*, may be obtained by Hjorth's electro-magnetic engine; this is an established fact, and we think that a careful examination of the engine at work, will induce scientific competent judges to declare, that its power might be unlimited, and every part of the machinery, at the same time, under perfect controul. Having only seen a small engine of rather more than a man's power, which is considered the working model, we are bound to distinguish between theory and practice, and to acknowledge the immense difference between an experiment on a large and a small scale.

The engine, when in motion, *proves*, that to every *action*, an *equal reaction* may *succeed*, by *reversing* the attractive *power*; or, that the mutual *attraction* between bodies may be equal in opposite or contrary directions. The elementary principles of the machine are, the magnet and the galvanic battery, — two *similar*, but independent powers or principles, which are thus admirably combined.

Such is a rapid and imperfect glance at the theory of the discovery. The practical demonstration, according to the specification of the patent, is, that the result is obtained by passing moveable magnets into hollow magnets, the inside parts of which are conical; and secondly, by placing a number of rods or points, of different lengths, in the hollow magnets, which rods are to pass through corresponding apertures in the moveable magnets. The consequence of this arrangement is, that the respective magnets mutually attract each other by the superficial approximations of their different parts, which, during the whole stroke, present themselves in different ways at the poles of the magnets, thus exercising their power by a direct pull, without being limited to any length of stroke, as this only applies to the number of rods applied in the same way.

It is with great pleasure we notice a great improvement in the construction of the magnets for obtaining motive power. The inventor has succeeded in preventing the destroying effect of the electric spark, by arranging the *commutator* or *current changer* in such a way that the electric fluid is, according to its *intensity*, divided into several separate currents, which pass round the respective magnets without communicating with one another; and as it has been proved that the electric spark, when of great intensity, produces a destroying effect on the conducting metals, which serve to break the current, it will easily be seen that this improvement is of great importance with respect to applying galvanic batteries of *great* power. The electric fluid is communicated through two conductors in connection with the battery, which alternately communicate with both sets of magnets, acting in an opposite direction, by which means an up-and-down motion is produced.

Perhaps it may be as well to observe that the motion is regulated in the same manner as in the steam engine—by transferring the power to the crank. There is another very interesting part of this valuable discovery, to which we wish to direct particular attention, namely, that the wheels on locomotive engines can be magnetised by magneto-electricity produced by the revolution of the wheels, and the required adhesion thus gained will enable the lightest engine, of sufficient power, to draw any weight.

Assuming that we are right in our conjectures, and that an *unlimited* and *lasting power* can be obtained, it follows that the power, once acquired, the *movement* is without friction, without the possibility of explosion, and without the remotest chance of collision between any parts of the machinery.

P.S. Since the preceding remarks were written, we have heard that a large engine, having a 13½-inch stroke, has been tried and worked so satisfactorily, as fully to establish the principle of the invention.

* For specification, see *ante*, pp. 409—433.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 25TH OF MAY.

THOMAS CULLEN, London, gentleman. *For improvements in apparatus for steering ships and other vessels.* Patent dated November 18, 1848.

1. On each side of the stern post an additional rudder is attached by gudgeons to the braces, so as not to interfere with the working of the main rudder when in use. The stern post is fitted with projecting strips fore and aft the additional rudders, which are level with their sides when out of action, in order that the run of the ship may remain smooth and even. The heads of these additional rudders pass up to the deck, one on either side of the main rudder, and are fitted with tillers, which work one under the other, and both under the main tiller. When the additional rudders are not required to be brought into action, their tillers are lashed together or made fast by wedges. In order to avoid the necessity of reeving fresh ropes to work these rudders, the one upon the barrel is divided midway between it and the side blocks, and the opposite ends fitted with hooks and cringles, whereby either rudder may be brought into use, as required.

2. In the case of ships propelled by screws which can be lifted on to the deck, a temporary rudder may be constructed of metal or wood, and in such a manner as to be slid up or down into the place of the unshipped screw. But in the case of other steam or sailing ships, the patentee proposes to employ a vertical frame, composed of the three sides of a square, so as to fit over the sternpost, which has a false sternpost attached to the back of the centre one. The false sternpost is furnished with braces terminating in gudgeons, which gradually increase in length from the top one to the bottom. A spar is passed through these gudgeons and rests upon the lower one, which is fitted with a heel to receive the end. The space between the false sternpost and the spar is planked over. Beneath each brace, on both sides of the fixed sternpost, there are projecting pieces which take into corresponding holes in the sides of the frame. The inclined position of the spar, arising from the increased length of the braces, allows of its being led up by means of suitable hoisting tackle through the hole in the stern for the ordinary rudder head on to the deck. The frame is provided on both sides, at top and bottom, with guys leading from either quarter of the ship, whereby it is hauled tight over the sternpost. It is then lifted up into position by the hoisting tackle, and there maintained by means of a bottom piece fixed to the frame, which catches against the keel, and by the hold of the projecting pieces of the sternpost in the holes of the frame.

Claims.—1. The additional rudder or rudders let into one or both sides of the sternpost.

2. The arrangement and mode of working the tiller and tiller ropes for steering the same.

3. The mode of applying a temporary rudder to ships propelled by screw power.

4. The application of the temporary rudder and mode of preparing the sternpost for receiving it.

THOMAS MASTERS, Regent-street, Middlesex. *For certain improvements in apparatus for making aërated waters, and in apparatus for charging bottles and other vessels with gaseous fluid; also improvements in bottles and other vessels and apparatus for drawing off liquids, in securing corks or stoppers in bottles or other vessels, and in taps or vent-pegs.* Patent dated November 18, 1848.

Here is a specification which literally defies correct analysis from the excessively illiterate, immethodical, and unintelligible style in which it is written. Each branch of the specification consists of but one sentence, with few capital letters, or points of any kind to furnish a clue to the sense—with half the words misspelt (*e. g.* gutt*er* percha, apparat*a*, or*a*fice, &c.,) and the whole thrown together in glorious disdain of all the rules of grammar — with figures moreover referred to which are not given, and figures given to which there are no references. We are not at all sure that we have been able to make out what the patentee would be at, and can only *guess* that the improvements meant to be specified are somewhat as follows :—

1. The carbonate of soda and tartaric acid, from which the gas is to be evolved "for making aërated waters," is placed in an earthenware or glass vessel, and the liquid to be impregnated in a similar vessel, which is inverted and attached to the first by a socket. Communication is established between the two by means of a compound pipe, whereby a portion of the liquid is conveyed to the soda and acid, and liberates the gas which ascends through the liquid of the top vessel. When it is sufficiently impregnated it may be drawn off by a tap fixed in the socket for that purpose. Or, the soda and acid may be placed in a perforated cylinder inclosed in a globe-shaped air-tight vessel, containing a portion of liquid and screwed upon the vessel in whish the liquid to be impregnated is placed. A pipe leads

from the top of the globe to the bottom of the vessel, and can be opened or closed at top from the outer side. The apparatus is shaken in order that the soda and acid may be wetted and the gas liberated, which, being unable to escape, will enter the open top of the pipe and descend to the bottom of the liquid, which it will impregnate.

The apparatus for charging the liquid into bottles is a slight modification of the preceding. The syphon tap for drawing off aërated liquids, consists of a pipe with a hole at bottom, which is forced to nearly the bottom of the vessel, and carries a box at top, with a piston and valve arranged so as to give passage, when required, to the liquids. In the tap for general purposes, the piston when depressed drives a column of air through a one-way valve into the vessel, and by its pressure expels the liquid through the tap.

The improvement in bottles and vessels consists in inclosing them in an iron casing, to prevent accidents from their bursting, and in furnishing them with projecting pieces for agitating a cooling liquid when plunged therein. The improvement in securing the cork and stoppers consist in the application of sliding discs, or loops of wire, or cord, or of hinged pieces to hold them in position.

The rubbing surfaces of the plugs and barrels are to be covered with gutta percha or vulcanized india rubber. And lastly, a vent-peg is specified, which is made self-acting by the employment of a springed top, which as the liquor is drawn off yields to the unbalanced pressure and admits sufficient air to establish equilibrium between the interior of the cask and the external atmosphere.

The substance of the different claims is for the application and arrangement of the various apparatuses, as described.

John Oliver York, 24, Rue de la Madeline, Paris, engineer *for improvements in the manufacture of metallic tubes.* Patent dated November 21, 1848.

Mr. York proposes to cast iron or steel tubes in thick short lengths which are afterwards to be rolled out to the requisite thickness by being placed upon a mandrel, of rather less diameter than the bore of the intended tubes, and passed while in a heated state between a pair of rollers, furnished with a number of grooves on their peripheries, which are of gradually decreasing diameter. Or, the short tubes may be slid on to a fixed mandrel, which is supported in the grooves of a series of pairs of rollers, and made at those parts which are in the grooves thicker than elsewhere, but not quite equal to the diameter of the bore of the intended tube. The diameter of the grooves of each pair of rollers decreases gradually till the last, which is equal to that of the exterior circumference of the tube. The thick tube is slid up to the first pair of rollers, which seizes hold of it, partially compresses it and passes it on to the next pair, which does the same, and so on throughout the series. At each succeeding operation the tube is shifted one-fourth round, in order that the roller may act upon different portions of the tube successively. The thick short iron tubes may be formed of bars with bevelled edges, bent round a rod and welded together when on the mandril by the action of the first pair of rollers.

The patentee proposes, lastly, to change the form of the flues in tubular boilers, from a circular into an oblong or rectangular one, by drawing them while hot through a die plate, which shall have the effect of pressing the sides together, and consequently of decreasing their area without decreasing their heating surface.

Claims.—1. The mode or modes of manufacturing iron and steel tubes by rolling or pressing thick short cylinders of these metals upon a straight mandril between a pair of grooved rollers.

2. The mode or modes of manufacturing iron and steel tubes by rolling or pressing thick short cylinders of these metals over and upon a stationary mandril between a series of pairs of grooved rollers.

3. The mode of decreasing the area without decreasing the surface of flues in tubular furnaces.

Alexander M'Dougal, Langsight, Manchester, chemist, and Henry Rawson, of the same place, agent. *For improvements in the manufacture of sulphuric acid, nitric acid, oxalic acid, chlorine, and sulphur.* Patent dated November 21, 1848.

The improvements sought to be secured under this patent, are as follows:

1. Rice is to be substituted for sugar or starch in the manufacture of oxalic acid.

2. The nitrous fumes, resulting from the manufacture of oxalic acid or any other process, are converted into nitric acid by being drawn by means of a pneumatic apparatus alternately through water and air. This is effected by means of a series of vessels, each filled two-thirds with water, and one-third with air, and provided with a pipe leading from the top of the one to the bottom of the other. The first vessel in the series is connected with the source of supply, and the last with the exhausting apparatus.

3. The sulphurous vapour is converted into sulphuric acid by a similar process. The first vessel is connected with the sulphur furnace, and contains nitric acid. The other vessels contain water only. As the process continues, the first vessel will be

exhausted of its nitric acid, which, passing through the series, will become condensed in the last of all, and its place supplied by pure sulphuric acid. At the conclusion of the operation, the last vessel containing the condensed nitric acid is put in the place of the first containing pure sulphuric acid, which is removed, and the operation renewed, whereby the loss of nitric acid is prevented.

4. The improvements in the manufacture of chlorine consist in treating chromates or bichromates (by preference those of lime) with hydrochloric acid in a free or nascent state. Chlorine is given off, and a chloride or sesque-chloride of chromium and a chloride of the base of the chrome salt produced. These latter products are treated with nitric acid, and the hydrochloric acid distilled off, for the formation of nitrates of chrome, and of the base of the salt originally used, which nitrates are subjected to heat and the nitrous vapours evolved oxydised and condensed, as in the first instance, for the production of nitric acid. What then remains is the chromate or bichromate originally employed, and which may be again used.

5. The improvement in the manufacture of sulphur consists in passing sulphuretted hydrogen through heated pipes, whereby the sulphur is deposited and the hydrogen driven off.

Claims.—1. The use of rice in the manufacture of oxalic acid.

2. The manufacture of nitric acid by passing the nitrous vapours alternately through water, or a weak solution of acid, and air containing oxygen, whether such vapours are produced in the manufacture of oxalic acid or otherwise.

3. The manufacture of sulphuric acid by the processes described.

4. The use of the chromates or bichromates in the manufacture of chlorine, in connection with the use of nitric acid for the reconversion of the bye products into the chromate or bichromate originally employed.

5. The decomposition of sulphuretted hydrogen by heat.

WILLIAM HOOD CLEMENT, Philadelphia, U. S., gentleman. *For certain improvements in the manufacture of sugar, part of which improvements is applicable to evaporation generally; also improved apparatus for preparing the cane-trash to be used as fuel.* Patent dated November 21, 1848.

These improvements relate to the whole of the different processes employed in the manufacture, from the expression of the juice to its crystallization.

Mr. Clement proposes to use four crushing rollers, and in pairs of unequal diameters. One of the large rollers is supported above the other three, in such manner that its circumference may touch, at certain points, the circumferences of the others. The last of the three lower rollers, which is equal in diameter to the top one, is supported in bearings placed rather above those of the first, so that the cane, which is fed in between this and the top roller, is delivered from between it and the last of the three lower rollers, in a vertical or nearly vertical position, and the escape of such juice as may remain in the canes after the three distinct bites they have received in their passage between the rollers, is facilitated.

The juice is conducted to the filtering apparatus, which consists of an endless band of wire cloth, which is made to travel over two rollers fixed in the same horizontal plane, and under a drum supported below them in a tank of water. Underneath the horizontal portion of the wire cloth, and between the two rollers, is a receiver, which catches the juice that falls through, and conducts it to a reservoir, having taps furnished with ball-cocks for regulating its flow into the first division of the evaporator, while the matters which have been separated from the juice are carried round into the tank by the revolution of the cloth. In order to free the endless band from these matters, and to prevent its carrying any portion of water round, two brushes are made to act against its surface—one beneath and the other above the level of the water.

A portion of the first division of the evaporator is fitted with a false bottom, under which the waste steam from the engine is made to circulate, while the other is heated by the passage of the products of combustion from the furnace. Across the centre of this division is a trough, open at top, and not reaching quite to the bottom. The liquor is kept by the action of the ball-cock at the level of the top of the sides of the trough, and the application of unequal degrees of heat causes the liquor to circulate from one end to the other, whereby the impurities that float upon its surface are made to topple over into the trough, whence they are conducted to the still-house. The liquor flows through a sluice-cock into the second division of the evaporator, where, in consequence of its being placed nearer to the furnace, it has a greater degree of heat imparted to it. A horizontal plate of iron, perforated with numerous holes, is hinged at one end to one of the sides, while the other end is connected to the engine of the works, whereby a rising and falling motion is given, which agitates the liquor, and consequently promotes evaporation, and prevents its being injuriously affected by heat,

by breaking the globules as they are formed. Above this division of the evaporator is fixed a drum, with blades upon its periphery, which, as it revolves, strike against the impurities floating upon the surface of the liquor, and tumble them over the sides of the evaporator. Or, a dish having a pipe in the centre, and a rising and falling motion communicated to it, may be placed in an inverted position in the evaporator. The effect of this arrangement will be to create a partial vacuum under the dish, into which the steam from the liquor will be drawn, and whence it will escape by the pipe. This escape is promoted by introducing an intermittent jet of steam into the interior of the pipe, which is worked by the movement of the dish.

The liquor is subsequently conducted to the concentrator, which is placed nearer the furnace than the evaporator, and where it is consequently heated to a higher temperature. After some time, it is ladled into another one placed over the furnace, which, when the liquor arrives at the "striking point," is tilted up to empty it into a trough, which conveys it to the crystalizing or curing case.

The steam boiler of the engine is composed of two cylinders, communicating with each other by legs. The lower cylinder has an eccentric flue through the centre. The products of combustion, after heating the concentrators and evaporators, pass around the cylinders and through the eccentric flue in the lower one to the chimney.

The crystalizing case is mounted on wheels, and divided into two horizontal chambers by two plates fixed to the sides, and having a longitudinal opening in the centre formed by the space between them, which can be closed, when required, by a curved plate placed underneath, and capable of being moved up so as to cover it. When the liquor is first run in, the longitudinal slit is closed, and remains so until the setting takes place, when it is opened, and the molasses allowed to fall through.

The apparatus for preparing the "bagass" consists of a cart, supported on a cranked axle, and having an endless chain at the tail, which is driven by the revolutions of the wheel, and provided with prongs. As the cart is drawn over the bagass strewed on the ground around the mill, the prongs seize hold of it, carry it up, and throw it on the ground in the reverse position to which it was at first, so that all sides become alternately exposed to the sun and thoroughly dried. When it is desired to gather up the bagass, the tail-board of the cart is removed, and the prongs, as they revolve, will speedily fill it.

To coagulate the vegetable albumen, without increasing the density of the saccharine solution, Mr. Clement employs a system of high-pressure clarification, which consists in heating the solution in a close vessel to the highest temperature practicable without injury, so as to prevent the escape of steam. The vessel is provided with a thermometer, and a safety valve loaded up to the requisite point.

The patentee remarks, that in clarifying saccharine solutions by the employment of a metal oxide, it has been found most advantageous to present it in a nascent state; and to effect this, it has been necessary to use an alkali or alkaline earth in excess, whence has resulted the inconvenience of the triple combination of the oxide, alkali, and sugar. He therefore proposes to avoid his by employing electricity to set free the oxide. With this view, he connects two platina plates with the poles of a galvanic battery; immerses one in the saccharine solution in which the salt has been previously dissolved, and places the other in a porous bag containing water, or a solution of the salt used, and also placed in the saccharine solution. The electric current in passing from the one plate to the other—the positive and negative electrodes—decomposes the salt in the saccharine solution. The oxide combines with the impurities at the one electrode, and the acid gathers round the other in the porous bag, whence it is removed as may be most convenient. He next proposes to filter the solution through a layer of phosphate of lime, in which are placed two electrodes similarly constructed, and united by a strip of metal, for the purpose of precipitating the portion of oxide in combination with the sugar. And lastly, to pass a current of electricity in the same manner through the animal charcoal employed in the clarification of saccharine solutions generally.

Claims. — 1. The arrangement of the crushing rollers of the mill.

2. The application of brushes to the filtering apparatus.

3. The arrangement for heating and scumming the liquors in the first division of the evaporator.

4. The improved means of agitating liquids to promote their more rapid evaporation; and in the case of saccharine solutions, to prevent their being injuriously affected by heat.

5. The arrangement of steam boilers in connection with the evaporators.

6. The double chamber cystallising and curing cases.

7. The high-pressure process of clarification.

8. The apparatus for preparing cane-trash for fuel.

9. Precipitating the impurities contained in saccharine solutions by causing them to combine with the base of a salt or an iron of a chemical compound through the instrumentallity of electricity.

10. The use or application of electricity to separate from combination with the sugar of saccharine solutions, and to precipitate the oxide employed in the clarification.

11. The circulation of an electric current through a bed of charcoal to promote the combinations which take place when, partially clarified saccharine solutions come into contact with the charcoal.

Henry Newson, of Smethwick, near Birmingham. *For an improvement or improvements in trusses.* Patent dated November 23, 1848.

These improvements consist in constructing the truss of a rod or bar of steel, which is made nearly round, and bent into the form required for fitting easily round the body of the patient without pressing inconveniently about the part to be supported. All except the ends is tempered and then japanned or covered with some suitable material. The ends are left in this untempered state to allow of their being twisted to suit the convenience of the wearer, and have bottom pads or discs attached to them by screws or rivets, which are covered with an elastic or non-elastic material as required. In the case of a single truss intended to be used to support one part only, one of the pads is made to fit over that part, and the other into the back beside the spine, but in the case where two parts are to be supported a double truss is used, which consists of two trusses united at the back by a piece of elastic webbing, which passes across the spine, while the back pads fit in on either side of it. The form, length, and strength of the spring are to be varied to suit the position of the injured part, the size, and strength of the patient. It is stated that in a majority of cases the use of this truss will render the employment of suspensory bandages unnecessary.

Claim.—The mode or modes of constructing trusses of springs bent round, or as nearly so as conveniently may be, with pads or discs attached to the ends thereof, as described.

Hugh Bell, of London, Esq. *For certain improvements in aërial machines and machinery in connection with the buoyant power produced by gaseous matter.* Patent dated November 23, 1848.

Two flying machines are described: the first, is "A Balloon Motor," which has a sustaining and propelling power; the second, "A Parachute Motor," in which the propelling power constitutes the sustaining power. This propelling power is produced by the revolution of Archimedean screws, or by a "shutter propeller," which has a forward and backward motion imparted to it. The balloon is attached by silk bands, instead of netting, to a frame, which is composed of iron tubes, and supports a boat, composed wholly or partially of gutta percha, and constructed to serve as a car, and, in case of the aëronaut falling in the water, as a life-boat. For this purpose, it is fitted with air receptacles, oars, mast, sails, &c. The balloon is steered by a fan-tail, and provided with buffing apparatus to prevent concussion in falling.

Peter Llewellin, of Bristol, Gloucester, brass and copper manufacturer, and John Hemmans, of the same place, brass-founder. *For improvements in the manufacture of cocks or valves for drawing off liquids.* Patent dated November 23, 1848.

The passage of the cock or tap is closed or opened by means of a disc, ground smooth, or provided with packing, to fit tightly over the aperture in the barrel. The disc is furnished with a rod, screwed at top, which takes into a female screw tapped in the stem of the handle, and with feathers fitting into the bottom of the barrel. The top of the rotary stem is provided with a flange or collar, ground smooth or fitted with packing, and a cap is screwed over it on to the body of the tap, in order to prevent the escape of water or steam.

Various modifications of this construction are shown and described, but which do not appear to possess any distinctive or important feature.

Claim.—The construction of the various parts described, particularly of the accurately-ground steam and water-tight shoulder of the rotating stem, with or without packing, whereby the disc valve is raised or depressed, guided (*sic* in orig.) and the cock rendered steam or water-tight.

Henry Archer, of Great George-street, Westminster, gentleman. *For improvements in facilitating the division of sheets or pieces of paper, parchment, or other similar substances.* Patent dated November 23, 1848.

This invention has for its object to facilitate the separation of postage stamps, tickets, labels, &c., one from the other as they are wanted, without having recourse to any cutting operation, and consists in punching a number of holes around each impression. This is effected by means of a machine, which consists of an ordinary framework, in which slides a bed-plate, fitted with clasps at each end, to retain the sheet of paper in position. One of the clasps is pushed outwards by a spring, to keep the paper at the requisite

degree of tension. The paper is drawn over a number of perforations arranged to suit the form of the stamp, label, &c., and which serve as matrices to a number of punches arranged in corresponding lines, and set in a plate attached to a plunger. A rising and falling movement is given to the plunger through the intervention of a crank-shaft from any prime mover, and a corresponding step-by-step motion is communicated from the end of this shaft, by means of suitable gearing, to the sheet of paper, so that the lines to be perforated may be brought over the holes in the plate at the time the plunger descends, and so that when it ascends, the paper may be moved one step forward, in order to bring the next succeeding portion over the holes and under the punches.

The punches may be made in the form of a lancet, so as to produce incisions instead of holes in the paper.

Claim.—The preparation of sheets or pieces of paper, or other similar substances containing postage stamps, tickets, labels, or other analogous impressions, so that they may be divided with facility when the natural tenacious adherence of the fabric, as a whole, is destroyed (for the above-described object) by either of the operations of stamping, piercing, or punching.

Christian Schiele, of Manchester, mechanician. *For certain improvements in the construction of cocks or valves, which improvements are also applicable for reducing the friction of axles, journals, bearings, or other rubbing surfaces in machinery in general.* Patent dated November 23, 1848.

The invention sought to be secured under this patent consists in making the seats or surfaces of contact of cocks, valves, axles, journals, and bearings of machinery of a curved form, instead of a rectilinear one, as has hitherto been the practice.

The machine for describing the curve is composed of a ruler against which slides a piece of wood having a metal rod attached to it by means of a pin. A bush, carrying a ruling pen underneath, is placed thereon, and maintained in the first position, and the pen in a vertical one, by the action of a spring.

When it is desired to strike a curve, the sliding piece and the rod are placed at right angles to the ruler, and the slide moved along the face of it, thereby dragging the pen after it, which will, when travelling over a smooth horizontal surface, describe a curve, the nature of which will depend upon the distance of the bush carrying the ruling pen from the end of the rod which is keyed to the sliding piece.

The patentee describes several figures, which show the modes of applying this principle of construction to the rubbing surfaces of cocks, valves, lifting valves, steam boiler regulators, axles, journals, and pivots of astronomical and other similar instruments, and bearings of machinery; but which are all such as would readily suggest themselves to the mind of any intelligent mechanic.

Claims.—1. The improvements in constructing the seats or surfaces of contact of cocks and valves which have to rub against each other for the purpose of cutting off the passage of fluids, &c.

2. The application of these improvements to the construction of axles, journals, and the bearings of machinery in general, for the purpose of reducing the friction resulting from pressure acting in the direction of their axes.

Specifications Due but not Enrolled.

John Jukes, Rosamond Cottage, Fulham, gentleman. *For improvements in furnaces and fire-places.* Patent dated November 18, 1848.

Frederick Bramwell, of Millwall, Poplar, engineer, and Samuel Collett Homersham, of the Adelphi, gentleman. *For improvements in feeding furnaces with fuel.* Patent dated November 23, 1848.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subject of Design.
May 16	1890	Charles Fletcher and Co.	Birmingham	Cylinder for brick-making machine.
17	1891	Henry Rowe Stevens	Newmarket	Smoke diffuser to cure smoky chimneys.
22	1892	William Parkins	Oxford-street	Doubly secure envelope.
,,	1893	Thomas Suttie	Greenock	Kitchen boiler.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Pierre Armand Lecomte de Fontainemoreau, of South-street, Finsbury, for certain improvements in weaving. (Being a communication.) May 22; six months.

Francis Edward Colegrave, of Brighton, gentleman, for improvements in the means of communicating between the passengers and guard of a railway train, or between the guard and engine driver; parts of which improvements are also applicable to working signals on railways. May 22; six months.

Solomon Israel Da Costa, of St. Helen's, in the City of London, civil engineer, for improvements in vessels for holding solids or fluids, and in machinery for manufacturing such vessels. May 22; six months.

Rees Reece, of St. John-street, Smithfield, and Astley Paston Price, of Margate, Kent, chemist, for improvements in the manufacture and refining of sugar or saccharine matters. May 24; six months.

Andrew Crosse, of Gloucester-place, New-road, Middlesex, Esq., for improvements in tanning hides and skins, and also in dyeing fabrics and substances. May 24; six months.

Thomas Goodfellow, of Tunstall, Stafford, earthenware manufacturer, and George Goodfellow, of Shelton, in the same county, potter, for improvements in the method or methods of preparing plastic materials for manufacturing purposes. May 24; six months.

Andrew Smith, of St. James's, Westminster, engineer, for improvements in machinery for, or methods of, manufacturing rope or cordage, and improved modes of fitting and using the same. May 24; six months.

Frederick Steiner, of Hyndburn, near Accrington, Lancaster, Turkey-red dyer, for improved processes and apparatus to be used in the Turkey-red dye on cotton and its fabrics. May 24; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 21ST OF APRIL, TO THE 22ND OF MAY, 1849.

Meyer Jacobs, of Spitalfields, Middlesex, gentleman, for certain improvements in the manufacture, stamping, and treatment generally of woven fabrics of all kinds. Sealed April 25; four months.

James Roose, of Darlaston, Stafford, tube manufacturer, and William Haden Richardson, the younger, of the same place, tube manufacturer, for improvements in the manufacture of tubing. May 7; six months.

Robert Oxland, of Plymouth, chemist, and John Oxland, of the same place, chemist, for improvements in the manufacture of sugar. May 4; six months.

Frederick Steiner, of Hyndburn, near Accrington, Lancaster, Turkey red dyer, for improved processes and apparatus to be used in the Turkey red dye on cotton and its fabrics. May 7; six months.

John Dalton of Hollingsworth, Chester, calico printer, for a certain improvement, or certain improvements, in printing calicoes and other surfaces. May 9; six months.

Alexander Munkittrick, of Manchester, Lancaster, merchant, for an improved composition of matter, which is applicable as a substitute for oil to the lubrication of machinery, and for other purposes. (Being a communication.) May 10; six months.

James Anderson, of Abbotsford-place, Glasgow, North Britain, starch manufacturer, for a certain improved mode of separating different qualities of potatoes and other vegetables. May 10; four months.

Alexander Swan, of Kirkcaldy, Fife, manufacturer, for improvements in heating apparatus, and in applying hot and warm air to manufacturing and other purposes where the same are required. May 14; six months.

Samuel Adams, of West Bromwich, Stafford, organist, for improvements in mills for grinding. May 16; six months.

Daniel Miller, civil engineer, of No. 168, St. George's-road, Glasgow, Scotland, for certain improvements in the mode of drawing ships up an inclined plane out of water, for which mode a patent was granted to the late Thomas Morton, of Leith, shipbuilder, on the 23rd day of March, 1819, and which mode has been commonly known as "Morton's Slip." May 21; four months.

Alphonse Garnier, of Paris, France, but now of South-street, Finsbury, Middlesex, merchant, for certain improvements in extracting and preparing colouring matter from orchil. May 21; four months.

Rees Reece, of St. John-street, Smithfield, and Astley Paston Price, of Margate, Kent, chemist, for improvements in the manufacture and refining of sugar or saccharine matters. May 21; six months.

LIST OF PATENTS GRANTED FOR IRELAND FROM THE 20TH OF APRIL, TO THE 20TH OF MAY, 1849.

Felix Alexander Testud de Beauregard, of No. 17, Rue St. Quentin, Paris, engineer, for improvements in generating steam and in the means of obtaining power from steam engines. May 19; six months.

Thomas John Knowlys, of Heysham Tower, near Lancaster, and William Fillis, of Shirley, Hants, mechanician, for improvements in generating, indicating, and applying heat. May 10; six months.

Samuel Brown, the younger, of Lambeth, Surrey, engineer, for improved apparatus for measuring and registering the flow of liquids and substances in a running state, which apparatuses are in part also applicable to motive purposes. May 15; six months.

John Smith, of Hare Craig, Dundee, N. B., factor to Lord Douglas, of Douglas, for improvements in the manufacture of flour, applicable in the making of bread, biscuit, and pastry. May 18; six months.

Advertisements.

NOTICES TO CORRESPONDENTS.

A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the Claims of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d. Post Office Orders to be made payable at the Strand Office, to Joseph Clinton Robertson, of 166, Fleet-street.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99a, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1347.] SATURDAY, JUNE 2, 1849. [Price 3*d*, Stamped, 4*d*.

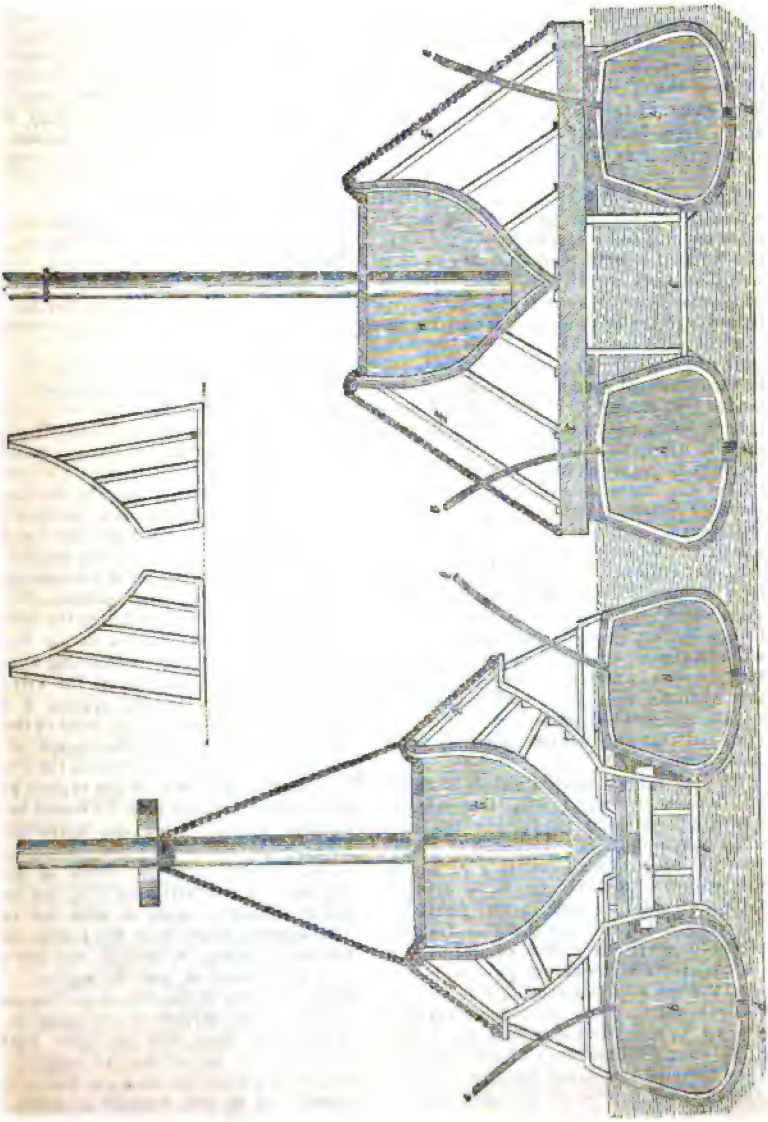
Edited by J. C. Robertson, 166, Fleet-street.

GOUGY'S PATENT FLOATING DRY DOCKS.

Fig. 2.

Fig. 3.

Fig. 1.



GOUGY'S PATENT FLOATING DRY DOCKS.

The scheme of employing floating dry docks for the repair of vessels is somewhat startling for its novelty, but it is founded on sound principles and offers many advantages; so that there seems every prospect of its being, ere long, very extensively adopted. Wherever there is any considerable extent of water space in communication with a tidal river unoccupied—as in the outer East India Dock, for example—two or three docks of this description might be very conveniently moored, and would afford great facilities for the prompt and speedy repair of shipping.

Figs. 1 and 2 exhibit the first of several arrangements for this purpose. *a*, represents the ship to be operated upon; *b b* are two balloon vessels, "capable of retaining when sunk any quantity of atmospheric air which may be put into them;" they are connected together by means of a strong framework of wood or cradle, *c c*, and in this state sunk in the water. The ship to be repaired is then brought over the position it is intended to occupy in the cradle; atmospheric air is next forced into the balloon vessels, *b b*, until this and the cradle and the ship are all raised together, more or less, out of the water as the ship rises. The shores, *ff*, are regularly placed to support the ship in an upright position upon the platform. Blocks are used to guide the ship, and removed, if desired, after the ship is in its place. When it is the keel of a ship which requires repair, the patentee fixes a series of frames, such as are represented in fig. 3, upon the upper surface of the platform previous to sinking it, so that when the ship is brought up above the surface she may be quite clear under the keel, and rest only with her planking upon those frames.

Another arrangement is shown in figure 4. *a a* is the ship; *b b*, the vessels; *c c*, a platform for supporting the ship when raised up. The platform is placed between two rows of piles, *e e*, and is free only to move up or down between them, but not in a longitudinal direction. The vessels, *b b*, and the platform are connected together by means of chains, *ff*, passed over one series of pulleys placed upon the sides of the vessels, *b b*, next to the dock, and then over another series of pulleys, *g g*, attached to the ends of the beams constituting the framework of the platform. The connected vessels and platform are then lowered to the bottom of the dock, and the ship floated in over the platform. Atmospheric air is then forced into the vessels, *b b*, until the ship is raised by the action of these vessels to the required distance above the surface of the water. Should not this be fully accomplished at the first operation, the vessels, *b b*, are again sunk (the chains, *ff*, being at the same time shortened by a winch placed at the side of the platform), and again charged with air; during which operation the platform, *c*, is supported upon the upright piles, *d d*, by means of a set of ratchets and palls, upon which the platform, *c*, and the ship, &c., may finally be made to rest, leaving the vessels, *b b*, at liberty to be removed for other purposes. *f* is a chain which connects the vessels, *b b*, together, so as to keep them in the most advantageous position for the action of the pulleys over which the chains for supporting the platform are passed. If the depth of water be such as to admit of the balloon vessels being placed under the platform, *c*, the patentee prefers employing them in that position.

Fig. 5 is an exterior side elevation of another apparatus for repairing ships, &c. The floating dry dock, *b b*, is placed in a basin, *k*, in which there is always sufficient depth of water to float the ships on which it is desired to operate. When the level of the water in the basin is higher than that of the outer harbour from the ebb of the tide, the floating dry dock, *b b*, is emptied by means of the syphon, *ff*, which is fixed at one end of the floating dry dock, *b b*, while the other, passing over the jetty, *h*, falls on the outside into the harbour. *l* is a box or case attached to the floating dry dock, *b b*, and communicating with the interior thereof by means of the valve, *n*; *r* is a pipe, by which the syphon is filled with water; *s*, another pipe, fixed in the top of the syphon, to allow the escape of air, but which may also be used to fill the syphon with water. The end of the syphon which falls outside the jetty must be closed by any suitable means during the operation of filling.

Fig. 6 represents one mode of effecting this; *t* is a valve-box; *u*, the valve, and *v*, a line to open or shut the valve. The syphon, when it is filled with water, and the opening, *r*, closed, and the line, *v*, pulled taut, is put in action. The valve, *n*, opens by the pressure of the atmosphere on the surface of the water in the floating dry dock, and the latter rises in proportion to the outflow of water. The syphon is a water and air-tight flexible tube, constructed in such manner as not to col-

Fig. 4.

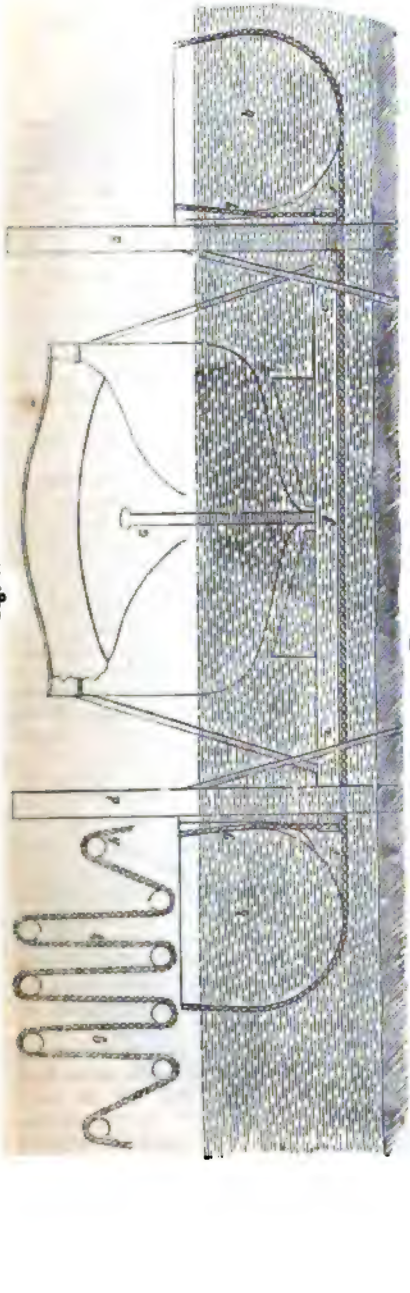


Fig. 5.

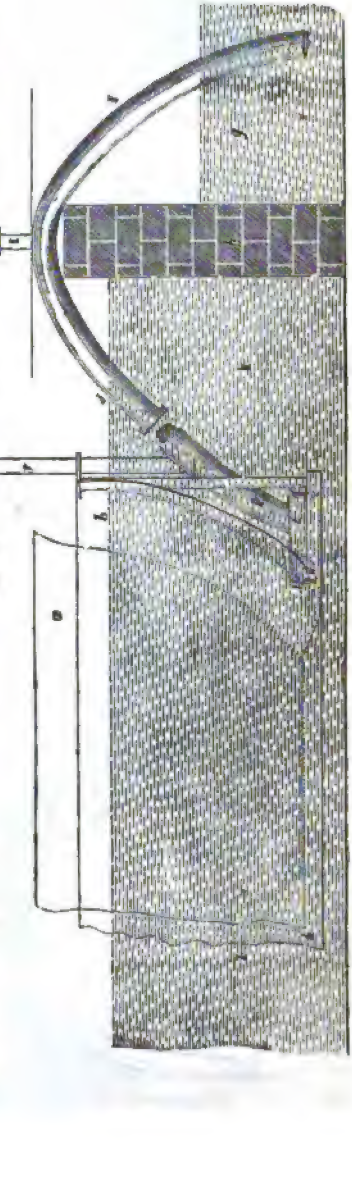


Fig. 7.

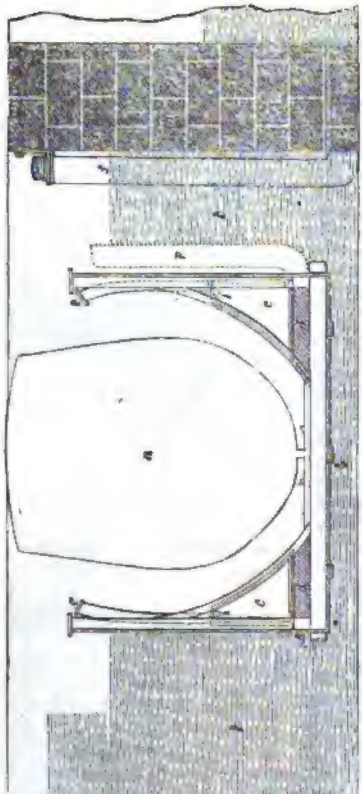
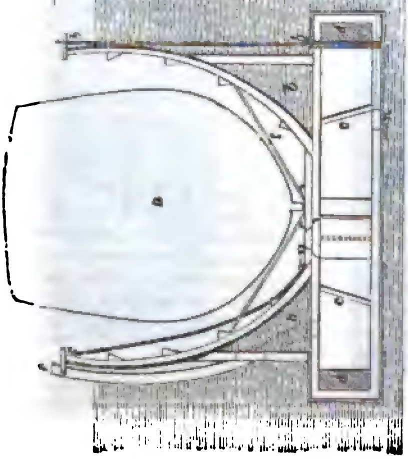
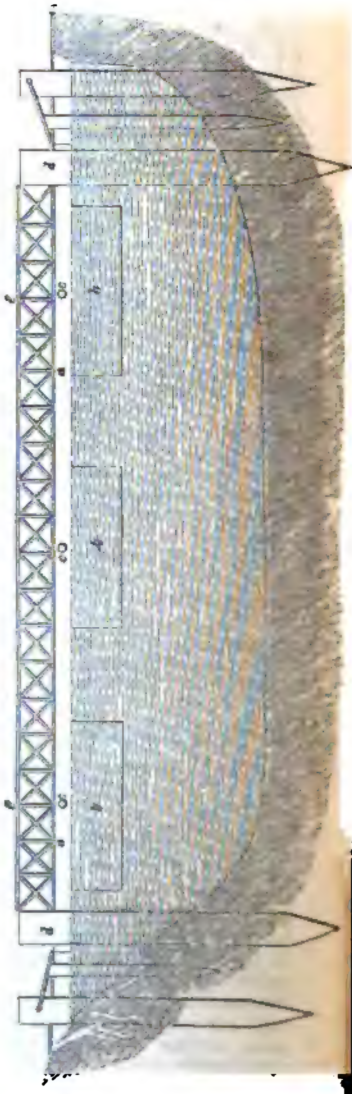


Fig. 6.





lapse; and the height to which the water is desired to be brought thereby must not be greater than the balance of atmospheric pressure will allow. Flexible air-tight bags, may be used instead of the cases, *c c*, to regulate the immersion of the floating dry dock.

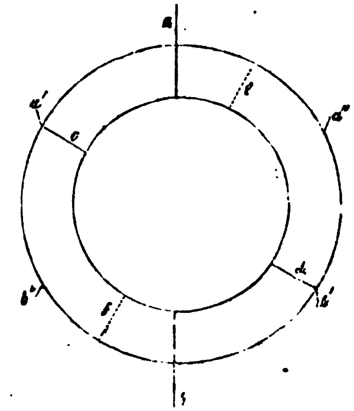
Fig. 7 is a sectional elevation of a floating dry dock, differing slightly from the one before described. The cases, *c c*, are placed inside at a distance one from the other, and communicate by means of a pipe, *i*. The mode of employing this floating dry dock is as follows:—*f* is a flexible pipe, which passes through the jetty, *h*, or floodgate, out into the harbour. The other end is kept above the surface of the water inside the basin, *k*; *p* is another flexible pipe, which is connected to the bottom of the floating dry dock. These pipes are then united, and allowed to fall down, when the water from the floating dry dock passes out into the harbour.

Fig. 8 is a longitudinal elevation of a floating bridge: *a a* are the beams, &c., forming the roadway; *b b* are balloon vessels similar to those before described, having openings below for the admission of water, and pipes at their upper sides for the admission of air to be pumped into them when it is desirable to raise the bridge to the surface of the water for use. *c c* are strong parallel guides placed at each end of the bridge, within which the ends of the beams of the roadway are placed, and work up and down. Instead of the beams and framework of the roadway being made in one piece, they may be of several pieces jointed together by hinges.

DAVIES'S ROTARY ENGINE.

Sir,—Since forwarding to you my reply to Mr. Dredge, which appears in the *Mechanics' Magazine* of 26th inst., it has occurred to me that it would be more courteous to Mr. Dredge, and would shorten the discussion, if I at once gave my demonstration that, even in the combined rotary engines, "dead points" occur. I therefore send you the following, as a postscript to my letter, and have likewise sent a copy of the same to Mr. Dredge, to give him an opportunity of replying to it and the letter at the same time.

In Davies's rotary engine, it must be borne in mind that the pistons move in equilibrio through an arc of 60° on each side of the steam stops, and that in the combined engines, the pistons in the one cylinder stand at an angle of 90° with the pistons in the other cylinder. Now, in the accompanying diagram, let *a b* represent the steam stops; the arcs, *a a'*,



a a'', and *b b'*; *b b'*, *b b''*, the spaces through which the pistons move in equilibrio by the impetus of the fly-wheel; the arcs, *b'' a'* and *a'' b'*; the spaces through which the pistons are impelled by the steam; *c* and *d*, the pistons in the front cylinder; the dotted lines, *e* and *f*, the pistons in the back cylinder; and the arrows, the direction in which the pistons move. The pistons, *c* and *d*, it will be seen, are 60° distant from the steam stops, and are therefore no longer pressed by the steam, but are just entering into a state of equilibrium; and the pistons, *e* and *f*, in the back cylinder, being 90° distant from the pistons *c* and *d*, are only 30° distant from the steam stops, and are, consequently, 30° distant from the points, *a'' b''*, at which the steam begins to act; and they must, therefore, be carried over this space by the impetus of the fly-wheel. But the pistons arrive at the positions shown in the diagram four times in each revolution; there will, therefore, be four dead points, extending over 30° each: and thus it will be seen that the combined engines require the aid of a fly-wheel through one-third of each revolution.

In my last letter, the word "parts" was printed instead of "*ports*," which renders the sense obscure. I am, &c.,

A. Z.

INSTITUTION OF MECHANICAL ENGINEERS.

Quarterly General Meeting, April 25, 1849.

Robert Stephenson, Esq., M.P., President of the Institution, in the Chair.

(Concluded from p. 496.)

(Smith's solid Wheels.)—By this mode of manufacture, Low Moor iron, or any other description of iron or steel, can be used if required for the tyre of the wheel, and thus in all cases ensure a clean wearing surface, and a compound character of fibrous and granulated iron, which it is believed no other system of making wheels affords.

The centres for large spoke wheels are also manufactured in one solid piece, in a similar manner, by tools or dies recessed in the form of the nave of the intended wheel, with a short portion of each of the spokes radiating from the nave. The centre of the wheel is thus stamped out by the hammer, with a portion of each of the spokes about a foot long, ready for welding on to the T-pieces to form the inner tyre and the remaining portion of the spokes. A thin web or fin is left in the centre between the spokes, which is afterwards cut out by the smith. The object of this construction is to surpass in certainty of soundness the precarious method of making them at present in use.

It is unnecessary to urge the importance of obviating, as far as possible, the occurrence of such accidents as have too frequently happened in consequence of defects of railway wheels; but a few of these cases may be alluded to here, in illustration of the subject.

The accident on the Edinburgh and Northern Railway, in October last, when the tyre of the leading wheel of the engine broke and threw the train off the line.

That on the East Lancashire Railway, in November last, where the tyre broke of one of the carriage wheels.

That upon the Brighton Railway in September last, when the tyre of one of the engine wheels broke, throwing the train off the line.

And that upon the Great Western Railway, about two years ago, where the tyre of a carriage wheel broke, and a portion of it broke through a carriage, causing a fatal accident.

With the view of obtaining some practical information upon the comparative resistance of the air to the revolution of the disc wheels and of the ordinary spoke wheels, some experiments have been tried at the Vulcan Iron Works, West Bromwich, by Mr. Henry Smith, with the assistance of Mr. Marshall, the Secretary of the Institution; and the results of these experiments are appended in the following Table :—

Experiments on the Resistance of the Air to the Spokes of Wheels.

Vulcan Iron Works, April 17, 1849.

No. of Experiment.	Description of wheel.	Weight of wheel.	Weight suspended on rope.	Distance fallen by weight.	Total time of revolution of wheel.	Total number of revolutions of wheel.	Average speed per hour of wheel.	Length of rope.	Time before rope was detached.	Revolutions before rope was detached.	Weight of the tail rope.	
No.	Wheel.	Lbs.	Lbs.	Feet.	Seconds.	No.	Miles.	Feet.	Seconds.	No.	Lbs.	REMARKS.
1	Losh	451	56	270	55	148	17	270	15	38	0	No tail rope; the rope was detached before weight touched bottom of pit.
2	Disc	414	56	270	62	161	17	270	15	38	0	
3	Losh	451	56	279	60	166	18	355	17	50	7	With tail rope.
4	Haddan	423	56	279	60½	176	19	355	17	50	7	Ditto.
5	Disc	414	56	279	65	220	21	355	17	50	7	Ditto.
6	Disc	414	56	279	66	222	22	355	17	50	7	Ditto.
7	Disc	414	71½	279	75	257	22	355	12	50	7	Ditto, and stone fixed on iron weight.

These experiments were performed at an old mine shaft, 279 feet deep.

The axle was placed across the top of the shaft and carried by two bearings with brass steps; the wheel under experiment was fixed on one end of the axle outside the bearing, and the counter connected to the other end of the axle. The counter was so graduated and arranged that the most correct observation could be taken of the number of revolutions completed in each case.

A drum 2 feet 3½ inches diameter was fixed on the centre of the axle, and a rope three-eighths of an inch diameter was coiled on the drum, with the moving weight attached to the end of it hanging over the centre of the shaft: the other end was not attached to the drum, but held only by the grip of the second turn of the rope, so that when the rope was run off the drum by the weight falling to the bottom of the shaft, the end of the rope detached itself from the drum without any check. As there was not any means of descending the shaft to bring up the rope and weight, a tail rope of the same length and size as the main rope was attached to the weight at one end and the other end made fast to the top of the shaft, the rope hanging double halfway down the shaft; this served to bring up the weight and main rope after they had fallen to the bottom of the shaft in each experiment. These two ropes weighed 7 lbs. each, and the weight of the main rope caused a gradual acceleration in the moving weight, varying from nothing at the beginning of the descent to 7 lbs. at the end; whilst the tail rope acting at first with half its weight, caused an increase varying from 3½ lbs to nothing at the end. The result was therefore, a total increase of the moving power varying from 3½ lbs. at the beginning of the fall to 7 lbs. at the end; and as this was the same in each case and the moving weight was also the same, (56 lbs.) its effect may be neglected in ascertaining the comparative results for the present purpose.

The wheels tried in the experiments were one of the solid wrought-iron disc wheels, a wrought-iron flat-spoked wheel of Losh's pattern, with spokes $3\frac{1}{16}$ inches broad, and a wrought-iron flat-spoked wheel of Haddan's pattern, with spokes $3\frac{1}{16}$ inches broad. These wheels were selected as near the same weight as was practicable, the Losh's wheel being one-eleventh heavier than the Disc wheel, and the Haddan's wheel one forty-sixth heavier than the disc wheel; all the wheels were 3 feet diameter.

In the four experiments, Nos. 3, 4, 5, and 6, (see the Table appended) the time in which the rope was run off the drum was the same in each case, 17 seconds, and as the number of revolutions in that time was also the same in each case (50), in consequence of the same rope being used; it follows that the velocity of the wheel at the moment of the power being detached was the same in each case, and consequently the comparative resistance in each case is indicated by the comparative length of time that the wheels continued in motion after the power was detached.

In the experiments, Nos. 1 and 2, the weight and rope were dropped down the shaft without the addition of a tail rope to pull them up again, and the rope was shortened to 9 feet less than the depth of the shaft so as to ascertain the exact moment of the power being detached from the drum.

The time was the same in both cases, fifteen seconds from starting to the power being detached, and the number of revolutions also the same, 38; this gives an average velocity of the circumference of the wheel from starting equal to sixteen miles an hour, or a final velocity of about thirty-two miles an hour, at the moment of the power being detached.

In No. 1 experiment with Losh's wheel the total time of the wheel revolving was 55 seconds, and in No. 2 experiment with the disc wheel it was 62 seconds, then deducting in each case the 15 seconds during which the power was in action, the results are 40 and 47 seconds respectively for the time of motion after the power was detached; which are in the proportion of 100 to 118, showing *that* 18 *per cent. more resistance* was experienced by the spoke wheel than by the disc wheel. In the four experiments, Nos. 3, 4, 5, and 6, the time was 17 seconds from starting to the moment of the rope being detached, and as the rope was in these cases longer than the depth of the shaft so that the weight stopped at the bottom before the rope was detached from the drum, 14 seconds may be taken as the time during which the power was acting; in Nos. 1 and 2 experiments where the weight of the tail rope was not acting, this time was ascertained to be 15 seconds.

In No. 3 experiment with Losh's wheel. the total time of the wheel revolving was 60 seconds; in No. 4, with Haddan's wheel it was 60½ seconds; in No. 5, with the disc wheel the total time was 68 seconds; and in No. 6, with the same wheel 66 seconds, the mean time of the disc wheel being 67 seconds.

Then deducting in each case the 14 seconds during which the power was in action, the results are 46 seconds with Losh's wheel and 53 seconds with the disc wheel, for the time of motion after the power was detached; which are in the proportion of 100

to 115; showing that 15 *per cent. more resistance* was experienced by the spoke wheel than by the disc wheel.

The average result from both sets of experiments is 16½ *per cent.* difference of resistance in favour of the disc wheel, and this is attributable to the additional resistance of the air caused by the flat spokes of the spoke wheel, as the friction of the axle caused the same resistance in each case; the weight being nearly the same of each wheel, and to prevent any change in the friction of the axle, the wheels were changed without taking the axle out of its bearings during the experiments. The axle journals were 2¼ inches diameter and 2½ inches length; and the friction of the journals was overcome by a weight of 15½ lbs. acting on the drum, when the wheel was upon the axle, and by a weight of 5¾ lbs. when the wheel was taken off.

As these experiments were made with wheels revolving on a stationary axle, it is requisite to consider what would be the comparative effect, if the wheels were rolling on their circumference whilst revolving at the same rate on their axle, as in the practical case of the wheels of railway carriages running on a railway. In the former case the motion of the spokes is at a uniform velocity, and always at right angles to the direction of the spokes; but in the latter case of a rolling wheel the motion of the spokes is at a varying velocity, and always inclined obliquely to the direction of the spokes, except at the moment of each spoke being in the vertical position. The outer ends of the spokes move in a cycloidal curve, having double the velocity of the revolution of the wheel when they arrive at the top of the wheel, but becoming stationary at the moment of touching the rail at the bottom of the wheel; the average velocity of the outer ends of the spokes is about 1¼ times greater than when the wheel revolves on a stationary axle at the same rate of revolution. The average velocity of the inner ends of the spokes is about 3 times greater when rolling than when revolving on a stationary axle. As the resistance of the air increases in proportion to the square of the velocity, the average resistance to the outer and inner ends of the spokes, will be about 1½ and 9 times respectively greater in the former than in the latter case. But this is reduced by the oblique position of the spokes as regards the direction of their motion in the rolling wheel; the motion of the spokes being twice during each revolution in the direction of the spokes, and consequently the resistance of the air reduced to nothing at those points. By measuring upon a diagram the comparative velocity of several points in a spoke in various positions during a complete revolution of the wheel, and the inclination of the spoke to the direction in each of these positions, the following approximate result has been obtained:—that the total resistance of the air to the spokes when the wheel is rolling is three times the total resistance to the same spokes when the wheel is revolving at the same rate of revolution on a stationary axle.

It follows that the result of the foregoing experiments has to be multiplied by 3, and consequently the excess of the resistance of the air to the spoke wheel over the disc wheel would have been 3 times 16½, or 49½ per cent., if the wheels had been rolling in this case instead of revolving on a stationary axle. This excess of resistance of the spoke wheel, would not be so great in the practical case of the wheels of a railway carriage running on a railway, as the friction of the axle journals is greater in that case than in the experiments, from the weight pressing upon them being greater; and consequently the resistance of the air to the spokes of the wheel would then bear a less proportion to the friction of the axle journals.

Mr. Smith exhibited a finished specimen of his wheel, and one of the moulds in the first stage of manufacture; also a centre for a wrought iron spoke wheel, which he had manufactured that day; it rang as clear as a bell when struck by a hammer.

Mr. M'Connell said, he had tried two pairs of these wheel centres at Wolverton, and had found them perfectly solid, and they were an excellent job; they were for the leading and trailing wheels of an engine, 3 feet 9 inches diameter.

Mr. Smith said, in answer to questions, that his hammer with which the wheels were forged was rather more than 9 tons weight; it was a helve taking up under the belly, and was driven by bands. The weight of the finished disc wheel was about 4½ cwt.; it was made with the first tools that he had started with, and he had adhered at present to his original section of wheel, but he did not profess it to be the best form of section that might be adopted. He had made about 200 of these wheels; there were some now at work on the Birmingham and Gloucester line, and he had an order to prepare some for the travelling post-office to register the number of miles run by them. As to the cost of these wheels, he was ready to put himself in competition with other parties.

The Chairman remarked, that the durability or life of the body of the wheel was so very much greater than that of the tyre of the wheel, which must be renewed when only about a tenth of the life of the wheel was gone, and would then require a second-

ary process to put on the new tyre; and consequently it appeared to him preferable not to incur any additional expense and trouble by forging the tyre on to the wheel, but to manufacture the disc alone, and put on a separate tyre in the first instance.

Mr. SMITH replied, that it was not any more trouble to forge the wheel with the tyre than without it; it was easily done, and the cost of manufacturing the wheel would be less than putting on a separate tyre. There would be a little more trouble and expense in re-tyring the wheel for the first time, but he thought that the iron of the tyre would be much more durable than any rolled tyre could be, on account of the process of manufacture.

Mr. WOODHOUSE asked what advantage the wheel would possess over a cast-iron wheel if it were forged without the tyre; but he thought there was certainly danger of fracture from expansion in a cast-iron disc wheel.

Mr. BEYER remarked, that he had seen some cast-iron wheels that he thought would last as long as wrought-iron ones, and he never could understand why they were not more used; there were many wheels of cast-iron, even large driving wheels of 6 feet diameter, that had been running many years, and he thought it was an important question of economy in railways.

The CHAIRMAN observed, that when locomotive engines were begun, some 25 years ago, they were driven to wrought-iron wheels; and he thought that for rapid railway travelling, they must admit, as a body of engineers, that wrought-iron was better than cast-iron for such purposes. The present facilities for the manufacture of wrought-iron had been so strikingly shown to them on the present occasion, that he thought it was hardly possible to save anything worth mentioning by the adoption of cast-iron, particularly in the expense of a pair of large driving wheels.

Mr. SMITH said, he had been informed that the tyres were found to wear longer on solid wheels than on spoke wheels.

The CHAIRMAN remarked, that the tyre of large wheels would no doubt deflect between the spokes, and this would not be the case with a disc wheel; there was certainly a bending process going on which might contribute to the wear and tear. But judging from the effects of rigidity in the wear of rails, he thought the tyre would wear faster on a rigid wheel; it was certain that rails laid on a block road wear much faster than when laid on an elastic road, and the difference in their wear was very marked.

Mr. MIDDLETON observed that, Mr. Ephraim Boulton had a patent for a disc wheel, and many of them had been used on the Great Western Railway, but they were not approved, and were all cast aside.

The CHAIRMAN said he believed these wheels were a double disc, and the tyre was riveted on; he understood that one principal reason for their being discontinued, was the singular drum-like noise they made.

Mr. ADAMS said, that these wheels were made with two wrought-iron discs riveted to a ring of T-iron to form the inner tyre, and riveted to the two faces of a cast-iron nave, which was turned to receive them; they had been in use eight years, and he thought they would last many years, and were as good wheels as the one under consideration, and much cheaper; he did not know why there had not been more of them made.

Mr. SMITH observed, that by forging the tyre solid on the wheel, the risk of accident from the breaking of the tyre would be avoided whilst the original tyre lasted; and he thought that advantage was worth ensuring, as many accidents had been caused by the tyres breaking or coming loose.

Mr. BEYER asked whether the wheels were all as good as the specimen exhibited to the meeting, and whether the two moulds of which the wheel was made were always perfectly united at the outer face of the tyre?

Mr. SMITH said, he would guarantee the wheels to be all as good, and the moulds were united as thoroughly and soundly in the forging as the bars in piled iron.

Mr. SLATE asked if he could tell what would be the probable wear of these wheels; but Mr. SMITH said there had not been sufficient experience of their working to ascertain that.

Mr. ALLEN remarked, that the disc part of the wheel was almost everlasting, it would last 100 years, but the tyre would not last more than three years.

The CHAIRMAN said, it was certainly a very good wheel, independently of the question of the tyre; and he was of opinion that the railway world was very likely to be greatly indebted to Mr. Smith for his very excellent wrought-iron wheel, and he saw no reason why it should not come into extensive use. About the tyre he had yet some doubt whether it was desirable or essential for the sake of a small portion of additional safety for two or three years, to forge the tyre solid with the wheel. He thought the mode of manufacturing the wheel was highly interesting, and it was a triumph in forging that he was not prepared for.

The SECRETARY next read a long paper, communicated by Mr. Hoby, of Brighton,

On the Construction of the Permanent Way in Railways.

[The abstract given of this paper in the minutes is of greater length than we have here room for. It may, perhaps, suffice to state, that the general object of the author is to show that, under the weights now given to the engines, and with the limited extent of the tyre in contact with the rail in section, the rails themselves are gradually crushing; and that this effect is more to be attributed to the engines with small-sized wheels used for goods traffic, than to the weight or speed of engines for express traffic, whose wheels are so much larger in diameter. Mr. Hoby proposes, therefore, to adopt a new sort of rail, the advantages and defects of which will be readily gathered from the remarks to which the reading of the paper gave rise.]

The CHAIRMAN observed, that it was an important subject for consideration; the main question seemed to be, whether the surface of the rails was actually suffering from the crushing action that Mr. Hoby spoke of. It looked almost as if they had reached the limit of their powers, when they began to crush the material.

Mr. McCONNELL thought that a greater breadth of bearing surface of the rails would not be found to yield the advantage anticipated by Mr. Hoby, as it was so difficult to keep the bearing of the wheels in a straight line, and extending over the whole surface of the rails.

Mr. WOODHOUSE remarked that the rail proposed appeared to him rather shallow for the purpose, being only 4 inches deep.

Mr. McCONNELL said, he should be afraid that the rail would deflect between the saddles when a heavy weight passed over.

The CHAIRMAN observed, that the rail was very considerably increased in thickness laterally, and appeared a strong rail; but it must be remembered that the strength was diminished in proportion to the square of the depth. He did not attach so much importance as the writer of the paper appeared to do, to the fact of the permanent way having deteriorated more rapidly in the last three or four years than previously. It was certain that on the older railways, which had been at work for 13 or 14 years, the deterioration of the rails had been much more rapid during the last three years of the time than the first three years; but he thought the wear and tear of the present rails had been much overrated. It must be remembered that the present heavy engines had been increasing in weight, whilst the rails had been getting older and more worn; and he believed that the weight of the present engines had got pretty nearly, if not quite, to the feasible limit.

Mr. WOODHOUSE remarked, there was an objection to the proposed plan, that broken chairs could not be replaced without taking the rail out, which would be very objectionable.

The CHAIRMAN observed, it would certainly be a serious objection if the rail had to be taken out in order to replace a broken chair; all practical men were averse to it. He thought the lip on the inner side of the saddles might be dispensed with, which would allow them to be changed without disturbing the rail.

MR. WALKER'S AND MR. MILLER'S IMPROVED COMPASSES.

[From the Sixteenth Annual Report of the Cornwall Polytechnic Institution, just published.]

The Secretary introduced Mr. Towson, Devonport, to the meeting, for the purpose of explaining the construction of the improved compasses of Mr. Walker and Mr. Miller, recently introduced into Her Majesty's Navy.

Mr. Towson exhibited these instruments to the audience, and said, the compass had lately engaged the attention of the Admiralty more than any other scientific subject. It had been found that improvements in ship building—the introduction of so much iron, especially in steamers—had introduced evils connected with the use of the Mariner's Compass, which had not previously been experienced. Those evils were of two classes: one of which had been remedied, to a great extent, by mechanical arrangements; while the other could only be compensated by calculation. It was the *mechanical* contrivance to which he had now to direct attention. In a storm, or during weather which would disturb a vessel considerably, the compass was very liable to rotary or oscillatory motion. The method of remedying that oscillation had, in his opinion, been greatly misunderstood. Those who had directed attention to the subject had endeavoured to obviate this inconvenience by adjusting the compass so that if disturbed, it might return to its former position in as short a period of time as possible. But, because of the disturbance being continuous during a storm, there was no time for the compass to return to its proper point. Mr. Walker, however, had attained this desirable object more nearly than any other manufacturer or improver of the compass. And this he had done by examining the cause of the deflection or oscillation of the

needle. That cause was this:—if a body were suspended at one end, and a sudden motion given to it, there would be occasioned an oscillation, from the *vis inertiæ* of the parts situated at a distance from the point where the motion was given; if the body were suspended immediately at its centre, one end of lever would compensate the other. But if needles were suspended from the centre of gravity, one pole would be drawn downwards, by the magnetic attraction of the nearest pole of the earth. To compensate this inconvenience a weight was placed, in northern latitudes, on the side of the point of suspension towards the south pole of the magnet. Mr. Walker's plan was not to compensate by weight, but by mechanical arrangement. Suspended on a beautifully cut agate hole on the centre of gravity (the compass itself being *beneath* that centre) was a *bell*, which prevented the deflection of the compass-needle by the magnetic influence of the earth; the wire on which the *apex* of the *bell* traversed being covered with *platina* to prevent corrosion. These compasses, Mr. Towson said, were the only ones manufactured in any of her Majesty's establishments. They had been tested under the superintendence of Captain Johnson, by the direction of the Board of Admiralty, against every description of compass suggested, and had been found to be the most steady storm compasses in use, in this or any other country. The consequence was, that there was now at Davenport dockyard, a manufactory of these compasses especially for the Royal Navy; and the Admiral Superintendent of that dockyard had entrusted the compasses now before the meeting to him, (Mr. Towson,) for exhibition here, it being the wish of the Admiralty that they should be more generally made known to the mercantile marine. It was not till last week (18-23 Sept. 1848,) that any compasses of this kind had been manufactured, except for her Majesty's Navy; but nearly every ship in the Navy was now supplied with them, and, he believed, no ship had reported otherwise than most favourably of them as storm compasses, against every kind put in competition with them.

Mr. Towson pointed out a modification of a scientific character of the needle itself, which was, that it was formed of two planes meeting each other at right angles, so that the transverse section of the needle would exhibit a representation of the letter T. The effect of this was that the poles would always lie in the line of intersection of these planes. The manufacture of these compasses was under the superintendence of a mechanic in the dockyard, named Goodfellow, of whom Mr. Towson stated incidentally, that he had produced one of the most powerful electro-magnets yet made. All tests applied to it had failed to ascertain its immense power. Consequently, these needles being magnetised by its influence, had a magnetic power greater than had hitherto been attained. Indeed it had formerly been considered disadvantageous to give much magnetic power to the needles; because in the old form of compass, the depression caused by the earth's magnetic influence, was thereby increased, and the compensating weight was required to be increased in proportion.

Mr. Towson next explained the magnet invented by Mr. Miller, the chief engineer at the Devonport dockyard. In the old compasses, as the navigator changed his latitude, it was necessary to alter the position of the compensating weight with relation to the centre of gravity. But in Mr. Miller's invention, the magnet, instead of being straight, is bent in the shape of an inverted V, so that the centre of gravity is much lower than the point of suspension; and if one end were depressed, by magnetism or any other cause, the arm of the needle on that side would be shortened, and its leverage, as it were, reduced, while the opposite side being raised in the same proportion, the disturbing force acted with the least effect, and prevented more than a very small amount of deviation of the card of the compass from the horizontal plane. Another advantage obtained by this arrangement was, that the planes forming the ends of this needle, instead of merely meeting, like Mr. Walker's, intersect each other, and thus advantageously expose one-fourth more service, thereby increasing the magnetic power of the needle. It was scarcely necessary to add that the section of this needle represented the form of a cross, instead of the letter T, as Mr. Walker's.

In answer to an observation from the Chairman, (Mr. R. W. Fox), Mr. Towson stated that the friction, caused by the mechanically restrained position of the needle, was more than compensated by the additional power given to the magnet itself. The cause of steadiness was, that these needles were poised previous to the magnetic influence being imparted; whereas, other needles were put into a state of equilibrium *after* the magnetic influence was given.

TWO IMPROVED GALVANOMETERS.

Sir,—I beg to submit to the consideration of your readers the accompanying descriptions and diagrams of two galva-

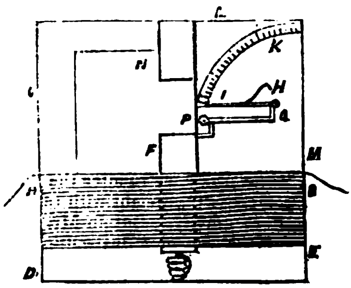
nometers which I have lately contrived, one of which I call a *lever*, and the other a *wheel* galvanometer.

I am, Sir, yours respectfully,

DAVID JONES.

Carmarthen, May 15, 1849.

The Lever Galvanometer.



A B is a coil of insulated copper wire, surrounding a short brass cylinder, inside which is placed the soft iron bar, F, closely fitting the cylinder, but having a free movement in both directions. One end of the bar is attached to a spiral steel spring, C, inside of the box, D, E, underneath the coil, for the purpose of rendering the motion of the bar steady and equable; the other end of the bar carries the arm, G, which has a small projection at its extremity, so as to act on the lever, P Q, which in like manner also acts on the index, I; K is a scale of equal parts, on which the movements of the index are made known; H is a small steel spring gently pressing on the index, that the latter may again be brought to zero when the voltaic current has stopped. All the levers are fixed on the upright board, L, M. N is another iron bar, placed vertically opposite to the bar, F, and supported by the frame, O.

When the instrument is to be used, by connecting the opposite wires of the coil with substances, the voltaic action of which we wish to ascertain, the iron bar, F, instantly becomes magnetised, and is consequently attracted by the bar, N, putting in motion the combination of levers on the board; the index I will therefore move from zero, on the scale in the direction, I, K, and the farther it moves the greater the quantity of the electric current.

The expansion and contraction of the bar consequent upon the changes of temperature, must always be taken into account when an estimate of the electric current is made, and an allowance made accordingly.

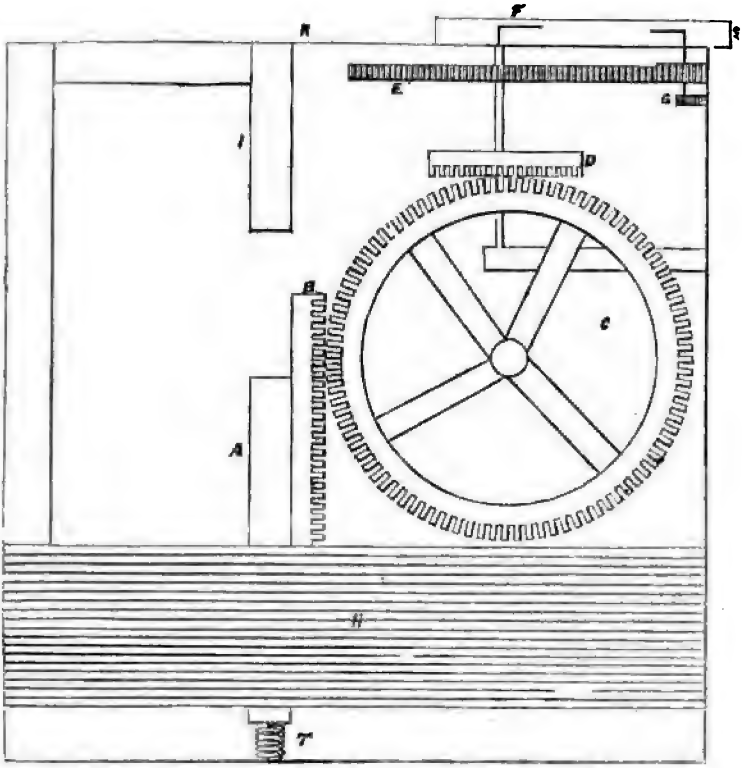
The Wheel Galvanometer.

The principle upon which this instrument acts is precisely similar to the one already described, with this difference, that the movement of the other is effected by levers, this by wheels, making it on the whole more portable and easy of reference, though more troublesome and expensive in the construction.

A is a bar of soft iron, attached to the spiral spring, T; B is a rack fixed to the side of the bar, its teeth acting on the adjacent wheel; H is the coil surrounding the bar; I is another iron bar, placed opposite to A, and supported by the frame; C is a wheel 6 inches in circumference, containing 60 teeth, which are of the same size as those of the rack. This wheel acts on the wheel D, 3 inches in circumference, and containing 30 teeth; on the same axis is the wheel, E, of the same size and containing the same number of teeth as the wheel C, an index, F, at the upper extremity of its axis points to a circular graduated scale on the dial-plate, R, S. The wheel E puts in motion another wheel, G, which contains 20 teeth, and has a circumference of 2 inches, likewise carrying an index the same as F. In the circumference of the wheel C, there is a groove, over which a small weight hangs, of such heaviness that it may just enable the rack to fall into its former position, and the indexes consequently move to zero.

When the extremities of the wire of the coil are placed in contact with substances capable of producing a voltaic current, the bar, A, becomes a temporary magnet, and is attracted towards I, putting in motion, by the upward movement of the rack, the train of wheels and the two indexes, which point out the strength of the electricity.

Supposing the bar with the rack to be attracted through the space of 1 inch, then the index, F, will pass over 120°, and G will make a complete circuit, or 360°; therefore, for every 1° that F



moves, G will move 3°. The index, F, will be the one for general reference, and the other to be referred to in case of more exact measurement being required.

The electric current when of low intensity or quantity might seem insufficient to cause any perceptible motion in the electro-magnet, owing to the reaction of the springs and the friction of the wheels and the levers; but when it is remembered that the voltaic current, however weak, does actually possess the power in some degree to magnetise any bar of iron, if the wire of the coil be of sufficient length, it will be abundantly evident that the electro-magnet will be attracted by the adjacent iron bar, and that however imperceptible that motion may be to the naked eye, still, by the combination of wheels and levers, its accumulation in the index will be so distinct, as to leave it a matter of little difficulty to determine the space through which the electro-magnet moved.

QUETELET'S LETTERS ON THE THEORY OF PROBABILITIES.*

The English press teems with volumes upon almost every subject; nevertheless, we seldom or never see an original treatise on the Theory of Probabilities, or on its application to the elucidation of other sciences. On the continent, we find Condorcet's elaborate application of the calculus to decisions. Laplace has applied it to natural philosophy, to Geodesic operations, and to a variety of other interesting inquiries. Poisson's celebrated work on the "Probability of Judgments" is a performance of which the

* "Letters on the Theory of Probabilities, as Applied to the Moral and Political Sciences. By M. A. Quetelet, Astronomer Royal of Belgium. Translated from the French by Olinthus Gregory Downes, Esq. C. and E. Layton, Fleet-street, London.

admirers of that profound analyst may well be proud.

What has been done in England in this particular department of abstract science during the last fifty years? Some parts of the works of the above authors have been made available to the English reader, and the writers who have so rendered them are entitled to suitable praise for their labours; but if an original treatise on the calculus of probabilities has been published, we have not been so fortunate as to meet with it. How is this? How is it that, in comparison with France in this respect, England has nothing to show. The question may be difficult to answer satisfactorily; but a probable solution to the apparent paradox may be suggested by the consideration, that the successful cultivators of the abstract sciences in France, during the period named, have been encouraged by the state. Upon the strength of their mental acquirements, evinced by the most refined and abstruse analytical productions, they have been promoted to dignified positions, which at once has shown the nation's respect for their talents, and has held out encouragement to the exertions of others. In England, on the contrary, the cultivators of abstract science, as such, get neither profit nor honour. The nation avails itself of the midnight labours of the solitary student, takes the formulæ which have resulted from the workings of his brain, turns them to its profit in machinery, or to its safety in navigation, but thanklessly and heartlessly allows the author to work on in obscurity, and to comfort himself upon cold neglect.

Take, for instance, the oldest, the most accomplished, and the most extensively known cultivator of the abstract sciences of the present day (Mr. Whitley), who has done more to form the taste and entice on the *self-taught* students of England than any other man living. Look at the whole of the miscellaneous mathematical literature of the last fifty years, which forms the great storehouse of supply for titled book-makers and pompous publishers. See whose genius has added a brilliancy to it throughout that lengthened period, and then inquire what has been done for him? You will find that nothing has been done—that the nation for which he has done so much, allows that honoured prince of science, to be now toiling for a maintenance, unnoticed and unprotected. Thus it is England rewards the cultivators of science!

No wonder, then, that we have so little done in the application of the theory of probabilities. There is no encouragement for men, having the requisite talents and acquirements, to apply themselves to such speculations. The publication of such works is expensive, and there is no hope that a treatise on such matters would at all remunerate the risk, leaving pay for the author's time and labour out of the question; consequently, such labours can only be published in the memoirs of learned societies, which are confined to the circle of select readers; and, accordingly, we find that Dr. Whewell, Mr. Tozer, and others have published their ingenious memoirs on these subjects in the "Cambridge Transactions," and in similar publications. But besides this national apathy to, and neglect of, the cultivators of abstract science, there are certain writers who strangely, yet strenuously endeavour to discourage the application of the theory of probabilities to such matters. One instance may be given:—

Not long ago, W. M. Best, Esq., A.M., LL.B., Barrister-at-Law, published a treatise on presumptions of law and fact, with the theory and rules of presumption on circumstantial proof in criminal cases—a work for which the whole legal profession ought to feel indebted to the learned author. The performance does him great credit, both as a scholar and a lawyer.

Presumption has been thus defined:—"Presumptio est probatio per argumenta, probabilia facta;" consequently, the very nature of the treatise is based upon inferences drawn from probable reasoning. In such a work, founded as it were on probability, and evidently intended to embrace the whole subject, one almost expects to find some reference to the calculus of probabili-

ties; hence the author does give a Note in the Appendix, headed "On the Application of the Calculus of Probability to Judicial Evidence." The Note was apparently given by way of making the treatise complete. It occupies only six pages. The author does not attempt to dogmatize upon the subject; he simply states the principles, and refers the reader to other works for more extended information.

Mr. Best's treatise has been made the topic of a lengthened review in a legal periodical, generally and very fairly considered the lawyers' classical journal. The reviewer has justly complimented the author on the great merits of his work; but the Note above referred to seems to have sadly baffled the critic: he evidently turned it this way and that way, and after puzzling over it, until his patience and good temper were exhausted, he was obliged to give it up, as an incomprehensible scrap, stuck in perhaps purposely to perplex the critic. The result is, that the critic thus criticises the Note:—

"Mr. Best has annexed to his work an application of the calculus of probability to judicial evidence. We fairly own that we look upon all such methods of trying the value of testimony as worse than useless. A certain number of probabilities lead the mind to a particular conclusion: in some cases, the testimony of a single witness is sufficient testimony for this purpose; in others, the oaths of one hundred would be inadequate. By what mathematical test are the probity and faculties of any witness to be estimated? If a witness of clear understanding and irreproachable character, without any motive to misrepresent, positively declares a certain fact within the limits of common experience to have taken place in his presence, we believe him. If twenty witnesses, inflamed with passion and notoriously corrupt, swear that they beheld the transaction bearing on the face of it the strongest marks of improbability, we should disbelieve them. Nor is it possible *for any analysis borrowed from the severer sciences conversant with unchangeable proportions*, and building upon *unvarying premises*, to adjust itself to the shifting nature of human testimony." * * * "Where is the mathematical calculus by which we are to decide the difference between the value of Clarendon's evidence when it is against and when it is in favour of Charles the First? What analysis of the sides of a die, or of the proportion of black and white balls in a balloting box, will enable us to calculate the effect of the daring enterprise, inflexible resolution, and ardent enthusiasm which were the ingredients of Cromwell's character?" * * "These are calculations which all the diagrams and tables of chances that ever were drawn out never will teach us to accomplish. For these we must have recourse, not to Laplace and Lacroix, but to Tacitus and Shakspeare." * * * "The very first condition of all matters subject to mathematical analysis, is, that they continue permanent or vary within certain limits subject to a certain law. Unless their fluctuation can be expressed with some tolerable accuracy by certain numbers, all attempts to reduce them within the domain of positive science must be chimerical, in consequence of the extreme variety of the phenomena."

The reviewer further strengthens his argument, by reason that Bichat complains of the introduction of a mathematical spirit into physiology. Having proved to his entire satisfaction how infinitely ridiculous it is to appeal to figures for an estimate of our hopes and fears, the reviewer breaks forth into singing in this manner:—

"For take thy balance, if thou be so wise,
And weigh the wind that under heaven doth blow;
Or weigh the light that on the earth doth rise,
Or weigh the thought that from man's mind doth flow."

In plain prose the critic next proceeds to cite some crackbrained notions held by Craig, and exultingly asks if human folly can go further? (as though Mr. Best had said that it could.) The reviewer asserts, that as facts cease to be public and interesting, error concerning them is more probable. "The same writer who is good authority on one point is suspicious on another—*and herein consists the stupid fallacy of mathematicians*, who suppose that *external facts*, DISTINCT *from themselves*, and depending on opinion, are to be calculated in the same manner as the angles of a triangle, and would annex the same credit to Gregory of Tours, when he describes his favourite miracle of saints holding up their heads for the executioner to embrace, as when he affirms

the existence of Trédégonde." It must be allowed that this is coming down rather hard upon mathematicians; but no matter. The reviewer maintains—

"That as long as mathematicians deal with *quantity* APART *from matter*, they reign without dispute; but when they DESCEND into *time*, and *space*, and *reality*, the difficulties with which they are beset are insurmountable."

The above quotations have been made to show in what manner an attempt to apply abstract science to legal subjects is treated in England by legal critics. The reviewer has spoken for himself, that readers who can may make out what he means. It has also been quoted because, in Professor Greenleaf's interesting book "On the Testimony of the Gospel," p. 35, it is said, "The calculus of probabilities has been applied by some writers to judicial evidence; but its very slight value as a test is clearly shown in an able article 'On Presumptive Evidence.'" The article referred to is the one above cited. Now, however ble the article may be in other respects, it proves nothing of the kind. The preceding extract is sufficient to show, that if the discussion proves anything, it is that the writer has very harshly condemned a subject which he had not taken the trouble to understand. On such a topic, the profound investigations of Condorcet, Laplace, and Poisson, are quite overwhelming when put in the balance against a number of hard words, however appositely they may be strung together.

Although we are under lasting obligations to French mathematicians for the masterly works above referred to, there is one fact which ought not to be overlooked, namely, that even Laplace is indebted to the labours of an Englishman for the germs of some of his most celebrated productions.

The Rev. Thomas Bayes published an essay in the "Philosophical Transactions" for 1763, towards solving the problem—"Having given the number of times an unknown event has happened, to find the chance that the probability of its happening should be somewhere between any two degrees of probability."

With becoming respect for the immortal Laplace, it must be admitted that in many of his astonishing fabrics he was not always very scrupulous about taking any one's material if it suited his plans; nor was he particularly frank in making due acknowledgments to the owners. He would occasionally lay hold of any one's bantling, dress it up in his own dazzling habiliments, and pass it off as one of his own paternity, leaving the world to find out the changeling if it could. With regard to our countryman, Bayes, however, Laplace in his essay actually adverts to the above-mentioned paper in complimentary terms. Poisson says, referring to what Laplace has done, "Principe que Bayes a presenté d'abord sous une forme un peu differente, et dont Laplace a fait le plus heureux usage dans ses memoirs et dans ses traité."—See "Recherches sur la Probabilité des Judgmens," p. 2.

English mathematicians must feel regret, and something like shame, when they reflect that Bayes' memoir, which elicited the praise of the most celebrated French mathematicians, and to which they are confessedly indebted for some of their productions in this part of analysis, was not considered worth transcribing into the abridgment of the "Philosophical Transactions" by Dr. Hutton and his two coadjutors. That performance of the three doctors furnishes another verification of the aphorism that a man is not without honour save in his own country. The trio of editors, instead of explaining any part that appeared to be intricate, and correcting any principle that seemed to be erroneous in the tract, as it was their editorial duty to have done—omit it altogether, with the idle excuse that it is difficult and intricate. The original "Transactions of the Royal Society" are scarce and expensive. Purchasers, moreover, naturally infer, that the voluminous and costly abridgment comprises all the most valuable and scientific parts of the original. The doctors, therefore, by throwing aside such tracts, instead of promoting English science, have been instrumental in suppressing memoirs

on which Laplace and others have founded some of their most esteemed works. One of our most celebrated cultivators of science, a few years ago, said, "that we had long given up the race in the mathematical sciences." Is this to be wondered at, when we see a set of titled English authors annihilating the labours of their predecessors? Contrast this strange and reprehensible course with that pursued by the continental mathematicians, who appear to vie with each other in carrying every original suggestion, no matter by whom made, to its utmost limits. Even Laplace could appreciate the labours of an Englishman; ay, and turn them to some account too!—though three English doctors could indifferently consign them to oblivion. It would be a pleasing reflection, if it were certain, that this were the only instance of the kind—and that these doctors were the last English authors who have attempted to smother an Englishman's scientific achievements.

The work named at the head of this article consists of letters addressed to H.R.H. the Grand Duke of Saxe Coburg and Gotha, by the celebrated Astronomer Royal of Belgium.

The contents are divided into four parts.

The first part gives the Theory of Probabilities.

The second part explains the Method and Application of Means and Limits.

Part the third treats on the Study of Causes. And

The fourth part illustrates the various uses of Statistics.

The Notes at the end contain some demonstrations of certain theorems together with appropriate Tables.

In each part the illustrious author has succeeded admirably in rendering a very intricate subject clearly comprehensible to common readers. To mathematicians and philosophers the volume is replete with important suggestions. But the valuable book is adapted for all readers; those who are not versed in mathematics, and know little or nothing of the calculus of probabilities, may, notwithstanding, peruse the treatise with profit and entertainment, whilst the mathematician will very probably find hints, as to how he may most advantageously apply his theorems and formulæ, to questions of the highest social interest. In a word, a master mind has been employed in breaking down, as it were, a hard and intractible subject, and making it easily intelligible. The celebrated Euler succeeded in treating somewhat similarly many matters in his "Letters to a German Princess." Our Airy has performed the same kind of feat in reducing the Involved Processes of the "Principia"—almost to a simple school book in his "Treatise on Gravitation." Only minds like these can grapple with such unmanageable subjects, so as to reduce them into simple elementary principles, and in that state place them before the general reader.

In the case of such a work as the present it is difficult to find a part for extract; we would willingly lay before our readers many of the excellent rules and directions which it contains; but we trust that they will speedily procure the book, read it, and judge for themselves. We must, however, select a very few paragraphs or specimens of the author's mode of treating his subject:—

"The Computation of Probabilities is but the instrument which thence regulate the labour of working the matter out; but it becomes indispensable in the researches to which we wish to apply ourselves. It ought, in fact, to enable us to distribute with advantage the series of our observations—to estimate the value of the documents that we may use—to distinguish those which exercise the greatest influence, and afterwards to combine them so that they shall err the least possible from the truth, and to calculate definitely the degree of confidence to be placed in the results so obtained. The Theory of Probabilities only teaches us in the main to do with more regularity and precision that which even the most judicious have hitherto done in a manner more or less vague. It tends, moreover, in the phenomena with which we shall have to occupy ourselves, to substitute science for that which is conventionally called practice or experience, and which is most frequently only blind routine." p. 5.

Laplace says, "Que la Theorie des Probabilities n'est au fond que bon sens reduit en calcul," Essai 273.

And Hartley, speaking on similar matters, says,

"The mathematical method of considering these things differs from the common one, just as the judgment made of the degrees of heat by the thermometer does from that made by the hand." "On Man," p. 211.

"The powers of man are limited. Nature is unbounded. The Supreme Being alone can see events proceed in accordance with his laws. To him time is nothing, and all imaginable combinations may be realised in succession. These apparent differences are only found within the sphere of man, and spread a remarkable variety over all the events in which he is concerned. This variety, which is in part his work, has however narrow limits, and cannot alter the general order of things." p. 64.

Speaking of the practice of registering, the author says,

"Since the commencement of the practice of registering with precision, those elements of the great phenomena of nature which are susceptible of calculation—meteorology, astronomy, and the other physical sciences, have, of a truth, singularly lost their character for marvels; imagination may have suffered, but reason is bettered. It is more than time that poetry also should mingle a little less with facts relative to man, and should permit us to see each thing without forcing our visual rays to pass through its deceiving prism." p. 105.

On the Study of Causes, the author observes,

"We here admit as a general position that *effects* are *proportionate to the causes* which produce them. This fertile principle serves (so to speak) as the foundation of all the sciences of observation." p. 128.

Again:

"If we wish to know whether mortality is influenced by the period of the year, we must compare the results of the different months of the year. We shall find that the mortality is subject at an interval of about six months to a *maximum* and a *minimum*. In our climate the *maximum* occurs in January, and the *minimum* in July: between these two limits the other numbers increase and decrease with regularity." p. 140.

"States, like the individuals which comprise them, are born, increase, and die. Their organisation and their laws of development present a succession of phenomena which constitute their political history. The mean duration of states has not, as far as I am aware, ever been inquired into; it is true that it is very difficult to find their commencement and their end. The duration of a state is generally shorter than that of the existence of a people; in fact, the social compact may be rent, and the people, without being destroyed, be driven from the territory they occupy. The Jewish nation is a remarkable instance of this. The contrary could not take place; for if the people be destroyed the state necessarily ceases." "Statistics," p. 176.

We had marked a few more passages for extract, and had intended to give the figures —a cursus of possibility—but we have already extended our article to too great a length.

In conclusion, we wish to remark that Mr. Downes, the translator, is well known to the readers of the Diaries, &c., and is peculiarly adapted for the scientific part of the task which he has undertaken. The translation does him great credit; he has very opportunely introduced this celebrated work in a dress entirely English; and it is a real acquisition to our scientific literature. We consider the work entitles the translator to the esteem of the British public, and we trust he will meet with that kind of encouragement which will induce him to labour on, in the cause of science.

THOMSON'S PATENT WHEELS.

We have recently had the pleasure of a drive in a carriage fitted with these wheels. Some improvements have been effected since we gave a description of them in a former Number (1233) which are of a very marked character. The leather case for the air tube has been replaced by a case made of a peculiar kind of canvas manufactured expressly for the purpose; and on the outside of the canvas, where it is liable to wear from coming in contact with the ground, a band of vulcanised India rubber is placed. The behaviour of the India rubber under this treatment is extraordinary. Not only does it not wear thinner, but the original surface remains wholly undisturbed. A curious proof of this was presented to us, on comparing a piece of new vulcanised rubber with the surface of the rubber on a carriage wheel which had been constantly at work for about two months. The new rubber

was marked on its surface by a clearly defined impression of fine cotton cloth (arising, we believe, from its being spread on cloth when in a soft state to form it into sheets), and this marking we found on the wheel as sharply defined as on the new rubber. On examining the two surfaces with a microscope, not the slightest difference could be detected between the new rubber and that which had been running through the wet grit and dirt of the London streets for two months. The markings on the surface of the rubber, although clearly defined, have no depth, so that if there had been the slightest wear they would have been at once defaced.

Despite the opinion most people would form, on first seeing the wheels, that the draught must be greatly increased by a soft and yielding tyre, the draught is unquestionably very much lessened. We ourselves have tried a series of experiments on the draught by a dynamometer, and are perfectly satisfied of the fact. The following Table shows the results of a great number of trials made with a dynamometer. The same carriage was tried with common and patent wheels over the same pieces of road, and with the same load in the carriage, and the conditions in all respects were, as nearly as possible, equal. The speed was nine miles per hour. The weight of the carriage with its load was 15 cwt.

	lbs.
On paved streets the common wheels require a force of . . .	48
The patent wheels	28
On clean, smooth, hard, Macadamised road the common wheels require a force of . . .	40
The patent wheels	25
On broken granite newly laid down the common wheels require a force of	130
The patent wheels	40

These results are entirely due to the fact that the tyres are perfectly *elastic* as well as soft. They do not sink into loose gravel or soft ground as common wheels do. Nor, on paved streets do they retard the carriage by receiving constant concussions from every paving stone or other obstacle they pass over—they yield to every inequality, permit the carriage to pass over it without rising up, and the elastic tyre expanding as it passes from the obstruction, returns the force borrowed for a moment to compress the tyre.

We entertain a confident expectation that these wheels will speedily come into general use. The perfect stillness with which they roll along, places them above any comparison with common spring carriages. The saving of horse flesh will more than repay their additional cost at first; and they can be renewed, we believe, at about the same expense as common wheels.

NOTES ON SOME RECENTLY SPECIFIED PATENTS.—ANGUS SMITH'S—MACDOUGAL AND RAWSON'S.

Sir,—You well deserve the praise of every reader of your valuable Magazine for having introduced into its pages the extremely useful addition of a concise view of all the specifications as they are enrolled—a matter of great importance to those who have not the opportunity of personally inspecting them in town, and more so, as it enables them to see whether any of the numerous patents which are granted interfere with processes already in operation. I was particularly struck with this on reading your Numbers for April 28 and May 26 of this year. In the first is a specification of a patent granted to Mr. Robert Angus Smith, of Manchester, for "Improvements in the application and preparation of coal tar," which improvements simply consist in applying molten coal tar or pitch to the insides of iron water pipes, previously applying a little linseed oil, to keep them from rusting. Now, surely, Mr. Smith must be aware that iron pipes have been so *blacked* to prevent them from rust ever since iron pipes were made, both for gas and water, and that thousands of tons of iron are every year "blacked," as the term is, to prevent them from rusting. Only let Mr. Smith step into any smithy he may meet with in his peregrinations (and there are a few at Manchester), and he will find that coating iron with coal tar, pitch, oil, is as old as pitch and coal tar themselves. Again; as to this preventing rusting, I fear Mr. Smith will find, as others have done, that when the pitchy coating gets hard it will crack, and that the rusting of these cracks will soon detach the coating. It may, however, do better for cast than wrought iron, as the former, from the pores on the surface, will give it a better hold. Now, for the other patent, which was granted to Mr. Alexander MacDougal and Mr. Harry Rawson, both of Manchester, for sundry improvements which are not more remarkable for their want of novelty than for their general want of utility. The only one which is of any real use is that for obtaining sulphur by passing sulphuretted hydrogen gas through

heated pipes, by which means the sulphur is deposited; and that process has been patented several times before in one form or another. I saw it at least ten years ago in work at a chemical manufactory, and at another about three years since, and have by me some of the sulphur so produced.

Need I say that these two instances occurring within so short a time, show that great benefit will ensue from the public being able to ascertain at once the substance of each specification, and so to detect pretenders in the very act (as it were) of pilfering from the public common. True it is that those patents are invalid, but an expensive lawsuit is the only way of proving it.

S. L. S.

May 26, 1849.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 25TH OF MAY.

JOHN GOUCHER, of Woodsetts, West Riding of Yorkshire. *For a machine for thrashing corn and other grain.* Patent dated November 25, 1848.

We quote the whole of the descriptive part of the specification of this machine. If the iron wire used to produce the channels be of a good size, and well polished, this will be one of the cheapest and most efficient thrashing machines yet produced.

"In the thrashing machine, as usually constructed, the straw and grain become crushed or broken. Now, the object of my invention, is to avoid such injurious consequences to the straw and grain to a greater extent than has hitherto been done. For this purpose, I construct a thrashing machine with grooves or channels in the surfaces of the beater by which the corn is beaten out, such grooves or channels being of suitable dimensions to allow of the corn and straw lodging therein and passing through, without being injured by the action of the surfaces, between and by which, the corn is beaten out and separated from the chaff. A thrashing machine so constructed will require less power to drive it, inasmuch as the straw and corn will pass through with great facility, provided the dimensions of the grooves or channels are suitably adapted to the kind of corn to be operated on. The revolving beater or drum in my thrashing machine consists, as in thrashing machines of the ordinary construction, of several longitudinal bars firmly attached to the arms or spokes, or to the periphery of wheels affixed to a central shaft or axis with which the beater or drum revolves. Figs. 1 and 2 show the end and side elevation of the revolving beater of my thrashing machine, with six longitudinal bars or beaters (but the number of such bars may be varied)

Fig. 1.

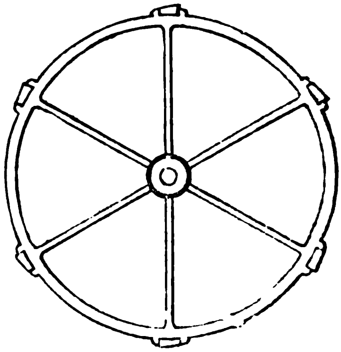
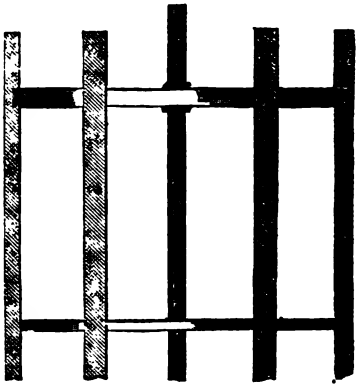


Fig. 2.



and figs. 3 and 4 show a front and end view of one of these bars. On the external or beating surface of these longitudinal bars

Fig. 3.

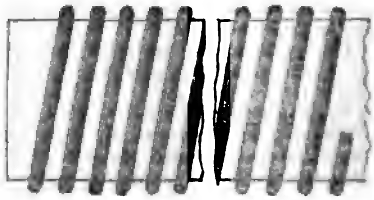
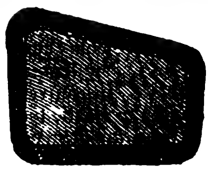


Fig. 4.



are grooves or channels; these may be produced either by a grooved plate of iron, securely fixed to the face of the longitudinal bars, or by winding iron wire about the bar in the manner represented in the drawing, taking care to secure the wire at each end (as shown in figs. 5 and 6) and at intermediate places, so as to prevent its becoming loose or slipping

Fig. 5.

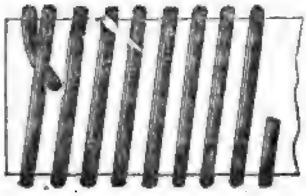
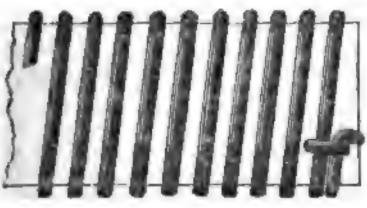


Fig. 6.



by the action of beating. In the figures the wire is represented as being wound round the beaters and inserted in notches at the edges. Also, the wire may be passed over the face or working surface backwards and forwards, care being taken to secure it firmly at the two sides of the bars on each turn. The depth and width of the grooves or channels may be varied according to the nature of the grain to be thrashed, and the general construction and arrangement of the other parts of the machine, and the method of driving it, may be the same as in the ordinary thrashing machines. I prefer, however, that the "roof" should be perforated so as to admit of the passage of the grain and chaff, thus facilitating their separation from the straw. For this purpose I construct the roof or circular envelope of perforated instead of solid plates, fastening them together and adjusting the distance of the roof from the revolving beater by screws, in the usual manner. The various parts of the thrashing machine are well known. I wish it to be understood, therefore, that I do not lay claim to the exclusive use of these several parts, except when employed in connection with, and for the purposes of my invention; and I hereby declare that I claim as of my invention a thrashing machine in which the surface of the beaters is grooved or channelled, and the roof perforated as above described."

Pierre Armand Lecomte de Fontainemoreau, Skinner's-place, Size-lane. *For certain improvements in the processes of and apparatus for treating fatty bodies, and in the application of the products thereof to various useful purposes.* (A communication.) Patent dated November 25, 1848.

Claims.—1. The general *modus operandi* and combination of various operations for the acidification, distillation, and solidification of fatty bodies, and apparatus employed therein.

2. The use of troughs of granite or enamelled metal (in treating fatty bodies ?)

3. The use of earthy substances and enamelled metal in the construction of worms and other condensers serving to heat steam to a higher temperature.

4. A mode of producing steam, heated to a higher temperature, and gases for the distillation of fatty bodies.

5. The bleaching, disinfecting, and solidifying vegetable tallow by means of azotic acid and oxygen, either alone or combined, assisted by other chemical agents; also chlorate of potash.

6. A mode of treating vegetable wax with azote and oxygen, when disengaged, to form alkaline azote, and the combination of chlorate and oxygen.

7. The use of steam of higher temperature to prevent the condensation of water which may be produced by the injection of steam, in its natural state, in the operation of heating vegetable wax and tallow.

8. A mode of treating Carnauba wax.

9. A distilling apparatus for making the distillation intermittent, and continuous and the mode of heating.

10. A combination of two stills whereby the operation is rendered intermittent and continuous.

11. The clarification of fatty matters before pressing.

12. A process by which the filtering of the substances is dispensed with.

13. A mode of treating oleine and stearine.

14. A mode of solidifying oleic acid and stearine.

15. A mode of manufacturing transparent yellow candles.

16. A mode of heating presses by the passage of a current of steam through plates, and their application to heating fatty bodies.

17. The employment and application of the refuse matters obtained in the distillation of fatty bodies, to the production of typographic ink, and other useful purposes.

18. The application of enamel to all apparatus employed in the treatment of fatty bodies.

William Rothwell Lomax, Banbury,

engineer. *For improvements in machinery for cutting hay and straw into chaff, and for cutting other vegetable substances.* Patent dated November 29, 1848.

In chaff-cutting machines, made according to these improvements, the cutters are placed on the cylinders so that the heel shall be just above the top of the straw; and such a curve is given to them that the point shall in the course of the revolution come below the level of the bottom layer of the straw. Upon the shaft of the cylinder is keyed a toothed wheel, which gears into another toothed wheel keyed upon a second shaft, on which are mounted two eccentrics, one of which works the mouth that alternately opens and closes upon the straw, either to allow of its passage or to hold it tightly during the cutting, while the other communicates motion through the intervention of cranked rods, levers, palls, and ratchet-wheels to the feeding rollers. The proportion of the cog wheels, one to the other, is such as that the shaft shall make as many revolutions as there are cutters while the cylinder only makes one revolution.

Or, the cutters may be arranged upon an open cylinder, working at right angles to the mouth, or on a frame having a horizontal traversing motion communicated to it, and fitted with a cutter sharpened on both sides, and working diagonally.

The improvement in machines for cutting turnips and other like vegetables, consists in making the cutters in a corrugated or angular form.

Claims.—1. Placing the shaft which carries the knives so as to range in the draughtway of the machine.

2. Causing the shaft (which gives motion to the feeding rollers and mouth-piece) to make one or more revolutions, according to the number of cutters on the cylinder, while the latter makes only one revolution.

3. The arrangement of eccentrics on the shaft in connection with the mouth-piece and other parts, as described.

4. The mode of uniting and working the feeding rollers.

5. Arranging the cutters upon an open cylinder, the axis of which works at right angles to the north.

6. The application of the to-and-fro sliding cutter, sharpened on both edges, and placed so as to work diagonally.

7. Making the knife or knives in machines for cutting turnips and other like vegetables in a corrugated or angular form.

JOHN LANE, Liverpool, and JOHN TAYLOR, Liverpool, engineers. *For improvements in engines, boilers, and pumps; in retarding carriages, in propelling vessels, in the construction of boats, in extinguishing fire.* Patent dated November 29, 1848.

1. The patentee first describes an improved rotary engine or pump, which consists of a cylinder keyed upon a shaft, and placed eccentrically within a second cylinder. The steam space between the two cylinders is closed by a piston, which turns loosely on the shaft, and is attached at top to a cross bar. The sides and under face, as well as the part of the cylinder through which the piston projects, are rendered steam-tight by packing. The outer cylinder revolves round the inner one, and the connecting arms of the piston travel in steam-tight passages in the cover of the cylinder.

Two modifications are described, which consist in fitting both sides of the piston with arms having slots, which embrace the shaft; or in making the piston of a curved form. A large wheel is attached to the outer or revolving cylinder, which communicates the power either by means of a band or by toothed gearing. It is stated that, by enlarging the steam passages, this engine may be worked by a fluid, or may be employed as a pump or fire engine.

2. The "retarding" apparatus consists of the usual breaks (applied to the bosses of the wheels), which are connected by jointed pieces to the ends of two levers, which are attached together by a pin, and connected by a rope, band, or strap passing over a system of pulleys to a sliding bar. When the bar is drawn out, the rope will lift up the ends of the levers, and, through the intervention of the jointed pieces, the breaks will be drawn simultaneously and uniformly into close contact with the bosses of the wheels, whatever may be the variations in the level of the carriages.

3. In order to render the stowage of boats easier than at present, it is proposed to construct them of metal ribs, attached to the keel and to the gunwale, with seats capable of being lifted out, so that different sized boats may be stowed one inside the other. Sliding pieces are fixed underneath the seats, and have cork or some other buoyant material attached to their outer ends, so that when drawn out they may serve to increase the buoyancy of the boat, and to prevent its capsizing.

4. It is proposed to construct rudders with equal portions fore and aft of the line of suspension; and, in the case of screw vessels, in two parts united at the centre by a slotted piece, through which the shaft of the screw passes.

5. The refrigerator and still in breweries are to be so combined together as that the products may be returned to the still; that is to say, a pipe is made to lead from the worm of the refrigerator to the still.

6. A perforated floating tray is to be suspended in the working vat, in order that

the barm may work through into it, and the fluid be returned.

Claims.—1. The arrangement of the various parts of the rotary engine or pump.

2. The mode of working the levers of breaks of railway carriages by straps, bands, or ropes.

3. The method of constructing boats.

4. The mode of suspending rudders.

5. The arrangement and combination of the still and refrigerator, whereby the products are returned to the still.

6. The application of a floating tray to the working vats of a brewery.

EDWARD SCHUNCK, Rochdale, Lancashire, chemist. *For improvements in the manufacture of malleable iron, and in treating other products obtained in the process.* Patent dated November 28, 1849.

This invention consists in separating the coating of tin from tinned iron scrap, in order that it may be manufactured into malleable iron, and in the subsequent recovery of the tin.

The tin iron scrap is placed in a boiling or hot solution of an alkaline sulphuret (by preference the persulphuret of sodium) containing sulphur in excess. The tin will be acted upon by the sulphur, and form a sulphuret of tin, which will be dissolved by the persulphuret of sodium, deprived of its excess of sulphur, and form what is termed by chemists a sulpho-stannate or stanno-sulphuret. The iron will be entirely freed from the coating of tin.

Or, the tin iron scrap may be placed in a solution of oxide of lead, in a caustic alkali or soda ley. The tin, acted upon by the lead, will form an oxide of tin, which will be in turn acted upon by the caustic alkali, and the metallic lead precipitated in the form of a black powder.

The iron scrap is then well washed with water, to free it from the solution, and when dried, placed in an iron cylinder of the capacity of about one cubic foot, which will contain, when subjected to moderate pressure, eight pounds. The cylinder is heated to welding heat, and the mass hammered as usual in the manufacture of bar iron.

To recover the tin in the first instance, the solution is boiled until a drop crystallizes on cooling, when the whole is allowed to crystallize, and strained through wire gauze. The crystals are placed in a press, to squeeze out the moisture, and subsequently in a reverberatory furnace, where they are exposed to low heat, and roasted. The sulphur is partly expelled, and an oxide of tin formed. A mixture of coal, charcoal, or other carbonaceous matter and carbonate of soda, is thrown in, and the heat raised. The tin is then run out in a melted state into coolers, in the usual way. The slack that remains is a sulphuret of soda, to which sulphur is added in excess, in order that it may be again used.

To recover the tin from the second and third solutions, they are boiled to the crystallising point. As the crystals form they are removed by a perforated iron scraper, and mixed while moist with carbonaceous matters, and treated as in the preceding case. The slack that remains in the furnace after the metallic tin has been run out is rendered caustic by the addition of quicklime and oxide of lead, or the chromate of an alkali.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
May 24	1894	Benjamin Levy	High Holborn	The Prince (an over-coat.)
,,	1895	William and George Ashford	Birmingham	Improved holder for whip-sticks and other similar articles.
,,	1896	John Pannell	Cowley, Middlesex	Calorifere for green-houses, conservatories, &c.
25	1897	Wm. Blackmore Pine,	Strand	The mimosa or flower cornet.
,,	1898	Wood and Co.	Grove, Southwark	Cigar lip-guard.
,,	1899	Douglas Hebson	Liverpool	Rudder casing, and rudder for vessels which are intended to be steered at each end.
26	1900	William Binion	Birmingham	Lamp for railway carriages.
29	1901	Theodore de Marillac	Manchester	Oil-can spout.
,,	1902	Silas Allen and James Rait Beard	Birmingham and Manchester	Improvement in braces.
,,	1903	Charles Walker and Sons	Little Sutton-street, Clerkenwell, Engineers	Hydrant and gas sluice-valve.
,,	1904	Benjamin Cook, Jun.,	Birmingham	Ever-tight bedstead sacking.
30	1905	Charlotte Henry	Islington	Anatomical stays.
31	1906	John Guest	Bedford	Barley-cutting machine.
,,	1907	Halford & Joseph	Tipton	Coke oven.
,,	1908	Thomas H. Pindar	Cheltenham	Self-adjusting waistcoat.
,,	1909	William Taylor	Birmingham	Crushing roller.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Edmund Grundy, of Bury, Lancashire, woollen manufacturer, and Jacob Farrow, of the same place, manager, for certain improvements in machinery, or apparatus for preparing wool for spinning, and also improvements in machinery or apparatus for spinning wool, and other fibrous substances. May 29; six months.

David Smith, of New York, America, lead manufacturer, for certain new and useful improvements in the means of manufacturing certain articles in lead. May 29; six months.

Richard Edward Hodges, of Bycroft, Hereford, gent., for improvements in mechanical purchases, which are also applicable in whole, or in part, to projectiles. May 29; six months.

John Dingdale, and Edward Birch, both of Manchester, tool and machine makers, for certain improvements in constructing and propelling ships, or other vessels. May 31; six months.

able at the Strand Office, to Joseph Clinton Robertson, of 166, Fleet-street.

NOTICES TO CORRESPONDENTS.

A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the Claims of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

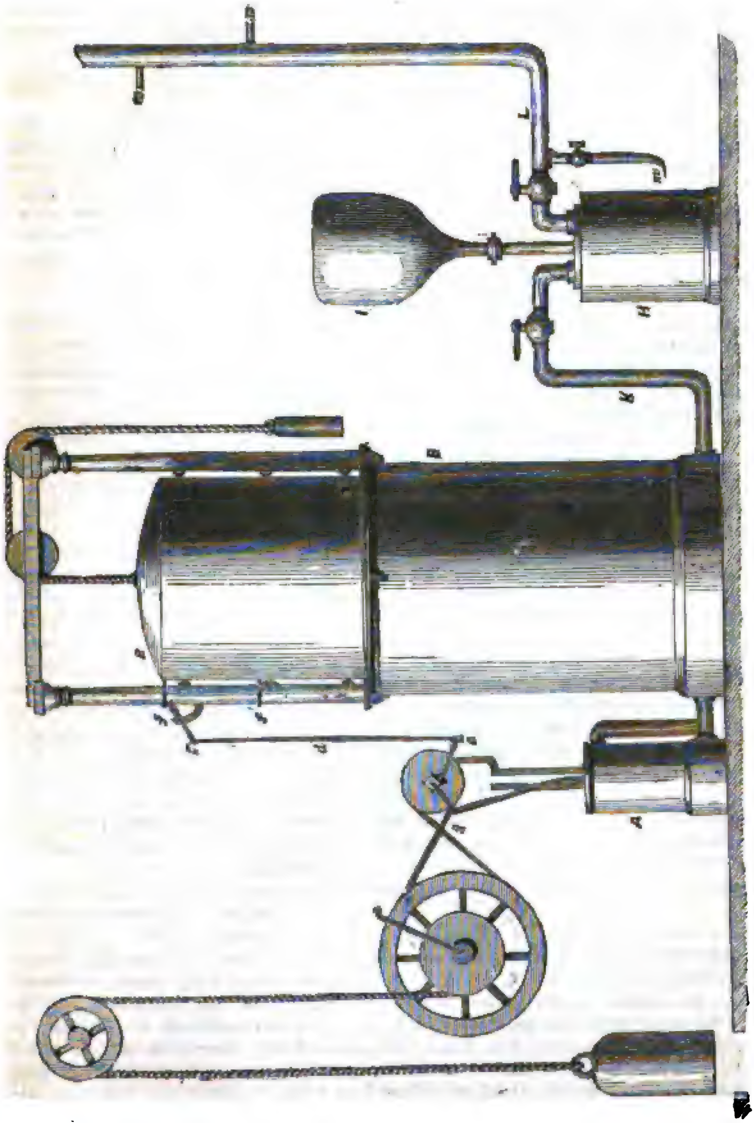
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1348.] SATURDAY, JUNE 9, 1849. [Price 3*d*, Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

MANSFIELD'S PATENT BENZOLE-GAS OR AIR-LIGHT-APPARATUS.



MANSFIELD'S PATENT BENZOLE-GAS. OR, AIR-LIGHT-APPARATUS.

Sir,—The numerous suggestions for "improvements in artificial light," which are from time to time offered to the public, are sufficient evidence that the art of illumination is, as yet, far from perfect. In one branch of application, scarcely any progress has been made,—in that of gas lighting, in systems of small extent. The numerous deficiencies and inconveniences of coal gas, which on the vast scale of modern cities are so comparatively small, that they almost disappear from the calculation, become evils of considerable magnitude in any more contracted sphere of operation, such as the illumination of single buildings. But in these latter cases, the advantages of system lighting over lamps, candles, and all isolated sources of light, are quite as great as in the former; and there can be no doubt that nothing but the want of a cheap and simple apparatus, and of a pure material, prevents its very general substitution for the more cumbrous method of moveable appliances. The production, then, of any contrivance presenting all these requisites cannot but be of very extensive utility.

At p. 362 of your current volume, you have described a step in this direction, the simplicity and neatness of which, as compared with any mode of gas making from coal, are obvious. In admitting to your columns the description of another invention having a similar object in view, you will, no doubt, agree with its author, that the world is large enough to give elbow-room for plenty of collateral industry. Perhaps one invention may be preferred in one place—another in another. However, I may be permitted to call attention to the chief points on which the system which I have to describe rests its claim to adoption No purifiers, condensers, retorts, furnaces, or meters are necessary, no fire need be used, and no coke, tar, or any sort of impurity or residual product formed in its application. It is equally available on any scale, from the compass of a city to that of a portable table lamp. The light is of perfect whiteness, and of great intensity, and at least as cheap as coal gas; at a distance from the sources of coal, cheaper. Like common gas, it may be rapidly lighted or extinguished, and the consumption may be regulated according to the varying requirements of time and place. The products of combustion are as pure as those of the finest wax, injurious neither to health nor to furniture. The odour of the light fuel itself is not unpleasant, but sufficient to betray it in case of escape. When worked on a large scale, if there should be leakage from the mains, the loss would be of common air, not of the luminiferous material. Finally, the whole generating apparatus may be comprised within very small dimensions, *e. g.*, for a single large mansion it need not occupy more than the space of eight or ten feet cube.

At p. 44 of your Number for July, 1848, you kindly inserted a synopsis of the specification of a patent, granted to me for this invention; and, at p. 400 of your Number for April last, an abstract of a paper which was read on this subject to the Insitution of Civil Engineers. For the farther information of such of your readers as may feel an interest in the matter, I send you the accompanying figure, which will illustrate the mode of its application. By reference to the papers just alluded to, it will be seen that the principle of my invention is the naphthalising of any suitable non-luminiferous gas by benzole — a highly volatile hydrocarbon, not before manufactured. A great variety of gases may be used as the vehicle of this light-fuel, such as hydrogen, carbonic oxide, the gases produced by passing steam over coke, any inflammable gas of "poor" quality, such as that distilled from wood, —or, lastly, common air. Whether one of the former gases or the atmosphere be consumed, will depend, in any given case, on the local relative cheapness or convenience of chemical or mechanical force. The annexed engraving, which I will proceed to describe, refers chiefly to a system in which the fluid wick that permeates the pipes is atmospheric air.

The figure is a diagram representing the principle on which the heart and lungs of such an organism is constructed.

A is an air-pump, working into B, an air-bell or gas-holder. A, of course, will be driven by the most convenient mode of applying force; this would be different in different places. In steam-ships, and buildings where steam power is at hand, the engine may be taxed. In town houses, where water is properly laid on, we have, as has been already pointed out in your pages by other writers, an excellent source of power.

In country mansions, churches, railway-stations, where manual labour is cheap, a weight wound up will form a reservoir of force, which leaves nothing to be desired. The mode of application and of regulation of such a motive agent is represented in the figure. The first of these is obvious, and needs no explanation; the second is very simple, and may be contrived in various ways: *e. g.*—*c e* are small levers connected by a rod, *d*, and moving on fixed axes in the centre of their length; *c* is caught by pins, *f f'*, projecting from the side of the gas-holder, and *e* is armed at its free extremity with a detent, which arrests the motion of the pulley and crank, *g*, when the pin, *f'*, presses on the arm of *c*; *i.e.*, when the air-bell, B, becomes nearly full. When B descends again to a certain extent, and requires replenishing, *f* presses down the arm of *c*, and so releases the weight, which by its descent again drives the pump, A, or bellows. H is the evaporator, a vessel charged with benzole; the liquid is maintained at a constant level in A by the fountain, I; K, the pipe by which the air enters H from B; L, the main by which it passes on for consumption; *m m*, service pipes by which, like common gas, it is conducted to the burners; *n*, a small branch and jet directed against the side of H, or of a water bath in which H may be immersed.

The use of the jet, *n*, is to keep up the temperature of the liquid, which will be reduced by the evaporation. The liquid is volatilised by the air current in ample quantity at the ordinary temperature of the air, but as it becomes cooled, it gives off less and less vapour. This is compensated by the small flame of *n*. So long as there is any of the liquid in T and air in B, the light may be obtained at the burners, by simply turning on the stop-cock, and kindling the gas.

In conclusion, perhaps, you will allow me to state that I shall be happy to show the method of illumination, which I have described, to any of your readers, who may wish to see it in operation: and that Messrs. R. Holliday and Co., of Huddersfield, and 128, Holborn-hill, will be ready to put up the apparatus, and supply the material, wherever they may be required. I am, Sir, yours, &c.,

C. B. MANSFIELD.

90, Regent-street, London.

A MODERN ANTIQUE.—BROWNE, *alias* GREGORY'S, SAFETY WINDOW-CLEANER AND FIRE ESCAPE, ETC.

Sir,—I apprehend there is not one among your numerous readers who does not as highly appreciate as does "S. L. S." (page 523) the importance and utility of "the concise view of all patent specifications as they are enrolled," given weekly in the *Mechanics' Magazine*.

The advantages of this popular exposition are manifold, and not the least is the facility thus afforded to the public for ascertaining the amount of *novelty* and *utility*, or the entire absence of both, in the several inventions sought to be protected by letters patent. And I would invite your correspondents to assist in this important object, by their comments on such as lie open to objections.

Thus, for instance; "John Browne, Esq.," has obtained letters patent for a window-cleaning apparatus and fire-escape, as set forth in his enrolled specification, a notice of which duly appeared at page 476 of your 1345th Number. Without disputing the *utility*, I beg to observe that the only point of *novelty* I can discover is the name, "balconlieu;" and in such matters, what's in a *name?*

But the mere assertion of want of *novelty*, without proof, ought not to have much weight; turn we then to the 11th volume of the *Mechanics' Magazine*, page 248, and there we find that, in the year 1829, Mr. John Gregory publicly exhibited, at the then "National Repository," a "safety chair for window cleaning," very similar, but in several respects superior, to that recently patented by Mr. Browne. This "window cleaner" Mr. Gregory subsequently improved, and converted into "a convenient and very efficient fire-escape, thereby making it a life-preserver of a two-fold kind." The machine in this, its complete state, was fully described, with engravings, in your 26th volume, page 11 (Sept., 1836.)

Mr. Browne's *fire-escape*, it is said, consists merely of a knotted rope attached to the "balconlieu." Mr. Gregory employed a wooden frame and cradle, in which females, children, and invalids, &c., might be lowered with safety.

Mr. Browne has, therefore, been anticipated by the invention of a more perfect apparatus nearly twenty years ago!

Fire-escapes, by-the-by, are, under almost any circumstances, ineligible subjects for patents; for, be they ever so novel or useful, there is no demand for them. Very many fire-escapes for domestic use have been described in your pages, the simplicity, cheapness, and fitness of which for their intended purpose can hardly be surpassed, and yet not any one of them has been extensively adopted.

"Men think all men mortal but themselves."

Ask a man to make his *will*—he will suspect you of a design upon his life. Persuade him to *insure* his property or to purchase a *fire-escape*, and ten to one but he will set you down for an incendiary forthwith.

Since the commencement of the present century, upwards of ten thousand pounds have been expended on *patented* fire-escapes UNPROFITABLY!

Mr. Gregory, the first, the most ingenious and most indefatigable of fire-escape inventors, sunk into the most abject poverty. Your correspondent, Mr. Wivell (who very recently departed this life at Birmingham), was perhaps one of the most fortunate of fire-escape inventors. His fire-escape, to the number of about twenty, was adopted by the Royal Society for the Protection of Life from Fire, who, although Wivell had no patent or legal claim, handsomely presented him with 5*l.* royalty for every machine they had built upon his plan. Besides these, Mr. Wivell built and sold a few fire-escapes to some provincial towns, but the expenses of a patent would have swallowed up more than all the profits; and the future demand is not likely to exceed, if it ever reaches, one per annum.

The heterogeneous medley composing the patent of Messrs. Lane and Taylor, the specification of which is noticed at p. 256 of your last Number, will doubtless create some surprise. The discrepancy between the title of the patent and the subject matter of the specification is remarkable.

The improvements in "engines, boilers, and pumps," are merged into a supposed new "rotary engine," but no improvement in "boilers" is set forth. The improvements in "retarding carriages" consists of "apparatus" applied to breaks. The improvements in "propelling" vessels, turns out to be confined to "steering" vessels, being specified as a mode of suspending *rudders!* The improvements in "extinguishing fire," must, I suppose, be looked for "in our next"—having no place in the present specification. The improvement in apparatus for *distilling* and *brewing* seem to have got into this specification by mistake, no mention of such improvements appearing in the title of the patent.

I am, Sir, yours, &c.,
WM. BADDELEY.

29, Alfred-street, Islington,
June 5, 1849.

THE EDDYSTONE LIGHT HOUSE—SMEATON'S OWN ACCOUNT OF THE PRINCIPLE OF ITS CONSTRUCTION.

Sir,—Of the many who have asserted that Smeaton took his idea of the form he would give to the Eddystone Light House from the trunk of an oak, few persons seem to have paid much attention to *his own* account of the matter; for according to that, he did not refer to the oak till *after* he had made up his mind from reasoning on the subject. In page 41 of his account of that work, he says, "On reflecting upon the late structure," &c., &c., (alluding to Winstanley's Lighthouse,) "in reality the violent agitation, *rocking*, or vibration which the late building was described to be subject to, must have been owing to the narrowness of the base on which it rested; and which the quantity of vibration it had been constantly subject to had rendered, in regard to its seat, in some degree rounding, like the *rockers* of a cradle. It seemed therefore a primary point of improvement to procure, if possible, an enlargement of the base, which from the models before me appeared to be practicable. It also seemed equally desirable not to increase the size of the present building in its *waist;* by which I mean that part of the building between the top of the rock and the top of the solid. If therefore I kept strictly to the *conical* form, a necessary consequence would be, that the diameter of every part being proportionably increased by an enlargement of the base, the action of the sea upon the building would be greater in the same proportion; but as the strength increases in proportion to the increased weight of the materials, the total absolute strength

to resist that action of the sea would be greater by a proportional enlargement of every part, but would require a greater quantity of materials: on the other hand, if we could enlarge the base, and at the same time rather diminish than increase the size of the waist and upper works, as great a strength and stiffness would arise from a larger base, accompanied with a less resistance to the acting power, though consisting of a *less quantity of materials*, as if a similar conical figure had been preserved."

Thus, it is evident, that the form given to the lighthouse was derived from *principles*, *not* from the *oak*—which principles led him.

1st. To give stiffness to the building by breadth of base.

2ndly. With a view to economy of time and money, to diminish as much as possible the quantity of materials employed.

3rdly. To render the surface to be acted on by the sea as small as possible.

It was not till *after* the reasoning process by which Smeaton had come to his conclusions, that he introduced the oak thus, "On this occasion the natural figure of the waist or bole of a large spreading oak presented itself to my imagination: and hence we may derive an idea of what the proper shape of a column of the *greatest stability* ought to be to resist the action of external violence, when the *quantity of matter is given* whereof it is to be composed." The words in italics are those so printed in Smeaton's work, 1791.

This reference to the oak has been noticed in the last *Quarterly Review*, p. 376, as to Skerryvore Lighthouse, "He thinks" (Alan Stevenson) "that Smeaton's famous analogy of the oak, which has been so often quoted and extolled for its felicity, is unsound, and was only employed by him for the purpose of satisfying readers incapable of understanding the profounder process by which he had arrived at the truth." "There is no analogy," (says "the modern architect") "between the case of the tree and that of the lighthouse, the tree being assailed at the top, the lighthouse at the base; and though Smeaton goes on to suppose the branches to be cut off, and water to wash round the base of the oak, it is to be feared that the analogy is not thereby strengthened; as the *materials* composing the tree and tower are so different, that it is impossible to imagine that the same opposing forces can be resisted by similar properties in both." "It is very singular that throughout his reasonings on this subject, he does not appear to have regarded those properties of the tree which he has most fitly characterised as its elasticity, and the coherence of its parts."

The Eddystone Lighthouse has been cited by high engineering authority as evidence in favour of a long slope; and on the other hand, by your correspondent "M.," as an example of the stability of vertical walls. Smeaton, throughout his work, says nothing indicative of any preference of his for a long slope; but on the contrary, it is to this very form of the Eddystone rocks under water that he attributes the immense swell they occasion, and the destructive force with which waves break upon the house rock. Your correspondent "H.," No. 1314, p. 368, says the "writer of the article in your last Number, p. 342, is very much mistaken in citing the Eddystone Lighthouse as an instance of the superiority of the vertical wall." True, that structure is not, *literally* speaking, a vertical wall, but it deviates so little from the perpendicular, that it may be considered as an upright column for nearly 60 feet; the spread of its base diminishing very rapidly, so as "not to increase the size of the building in its waist, that part of the building between the top of the rock and the solid." This column, being from the level of the rock, including the spread at the base, at an angle of about eighty degrees, can never be considered as a *long* slope like the Plymouth Breakwater; which, (as appears in your Number 1313, p. 344) is an inclined plane of only eleven degrees. The Eddystone Lighthouse is, in violent storms, up to its very summit exposed to the fury of the waves; they envelope it, and break over the lantern; yet this all but upright column has for these ninety years resisted the severest storms—the long slope in Plymouth Sound has been damaged, more or less, on the recurrence of every such storm from the first commencement of the work to the present time.

As to the concave form of the Eddystone column for a few feet at its lower point, by a fair construction of Smeaton's own words, the conical was rejected, the concave given, to *save materials*—hap-

pily for the eye of taste, since the curved line, so saith Hogarth, is the line of beauty.

Superincumbent weight, which Smeaton insisted so much upon as a source of strength, and on which great dependence has been placed in the Skerryvore Lighthouse, is a quality inherent in the upright wall, where every stone, as height is increased, adds to the strength of the mass below. In the long slope, on the contrary, it is only at the apex that superincumbent weight is in full force, whilst at its lower extremity this source of strength is as nought.

I am, Sir, &c.

S.

ON THE SYMBOLS OF ALGEBRA, AND ON THE THEORY OF TESSARINES.

Sir,—In an article bearing the above title, and published in the present (June) Number of the *Philosophical Magazine*, I have made some remarks on algebraical nomenclature, which, although they will not be merely repeated here, will at least form the basis of a portion of this communication, the which I may preface by remarking that all symbolic quantity is comprised under one or more of the following six species, viz., Number, Negative Quantity, and the quantities which we may distinguish by the respective names Unreal, Impossible, Typal, and Ideal. These six species may be generically arranged in a variety of ways, which it may perhaps be worth while to enumerate. And, first, we may adopt the two genera of *arithmetical* (or *numerical*) and *unarithmetical*. The genus of arithmetical quantities will comprise *number*, and number only. All the other five species of quantity are unarithmetical. Secondly, we may consider quantity under the aspect of *real* and *imaginary*. The genus *real* comprizing *number* and *negative quantity*, and the genus *imaginary* consisting of *unreal*, *impossible*, *typal*, and *ideal* quantity. Thirdly, we may divide quantity into the genera *possible* and *anomalous*; the genus *possible* including the three species Number, Negative, and Unreal Quantity, and the genus *anomalous* the remaining three species. In other words, *real* and *unreal* quantity is Possible, while *impossible*, *typal*, and *ideal* quantity is Anomalous. Fourthly, we may include *possible* and *impossible* quantities under the term *algebraic*, and *typal* and *ideal* quantities under the term *hyperalgebraic*. Lastly, we may consider *algebraic* and *typal* quantities as together constituting a genus to be called *normal*, while the remaining species—*ideal* quantity—considered in its correlation to the genus Normal, may be termed *abnormal*.

I have already (*supra*, p. 294) referred to a paper on Triple Algebra, by the Rev. Charles Graves, of Dublin. If we adopt the reasoning of paragraphs 10, 11 and 12 of his paper (see *Phil. Mag.*, s. iii., vol. xxxiv., pp. 125—6) and apply it to the Theory of Tessarines, we have the following interesting result. Let

$$M^2=(w\pm y)^2+(x\pm z)^2,$$

and call M the *true modulus* of the tessarine, t. Also let M' and M'' be the corresponding functions for the tessarines t' and t''. Then we shall have

$$MM'=M''$$

provided t, t', and t'' be related as at page 105 of this volume. I may add that, if we adopt a notation which I have before introduced into this Magazine (*vide supra*, p. 105), we have

$$M^2=\mu^2\pm 2\nu^2.$$

I am, Sir, yours, &c.,

JAMES COCKLE.

2, Church-yard Court, Temple,
June 1, 1849.

ON CONJUGATE FACTORS.—BY PROFESSOR YOUNG, BELFAST.

It may sometimes be convenient, when a pair of conjugate factors is already given, to change the pair into other forms without adverting to the original expression; and this may easily be done from the following considerations. As already shown, at page 414, the general type of the conjugate factors of x is

$$F+\sqrt{(F^2-X)}$$
$$F-\sqrt{(F^2-X)}$$

as is obvious from the known principle that the sum of two quantities multiplied by their difference gives the difference of their squares. Whatever F may be, we may, instead, write $F+k$; when the forms will be

$$F+k+\sqrt{(F^2+2Fk+k^2-X)}$$
$$F+k-\sqrt{(F^2+2Fk+k^2-X)}$$

which shows that if we add any quantity k to the rational part F, we must add $2Fk+k^2$ to the part under the radical.

This suggests a variation of the process, given in the place referred to, for obtaining the formula for the solution of a quadratic equation. Thus, taking as before the equation

$$x^2+px+q=0 \;\ldots\ldots\; (1)$$

we have

$$x^2=-px-q\,;$$

so that a pair of conjugate factors is

$$\left.\begin{array}{l} x+\sqrt{(-px-q)} \\ x-\sqrt{(-px-q)}. \end{array}\right\}\ldots\ldots (2)$$

And if now we introduce k, as above, and determine it so that $2k$ may be equal to p, that is, make k equal to $\frac{1}{2}p$, we shall have the conjugate factors

$$\left.\begin{array}{l} x+\frac{1}{2}p+\sqrt{(\frac{1}{4}p^2-q)} \\ x+\frac{1}{2}p-\sqrt{(\frac{1}{4}p^2-q)}, \end{array}\right\}\ldots\ldots (3)$$

and therefore, as before,

$$x=-\tfrac{1}{2}p\pm\sqrt{(\tfrac{1}{4}p^2-q)}.$$

It is likely that a beginner would consider this to be as satisfactory a method of determining x, in a quadratic, as that which depends on *completing the square*. All that he would have to do would be to write the significant member of the equation (1), as the *difference* of two quantities, viz.:

$$x^2-(-px-q)$$

which, decomposed by the early-taught principle adverted to above, becomes replaced by the factors (2); which, as here shown, are convertible into (3).

The formula known by the name of the Hindoo Method, is of course obtainable in a similar way: thus the equation being

$$ax^2+bx+c=0\,;$$

$$\therefore\; 4\,a^2x^2+4\,abx+4\,ac=0\,;$$

$$\text{or } 4\,a^2x^2-(-4\,abx-4\,ac)=0,$$

of which the unmodified factors are,

$$2\,ax\pm\sqrt{-4\,abx-4\,ac},$$

and these, by the principle explained above, may be replaced by

$$2\,ax+b\pm\sqrt{b^2-4\,ac},$$

so that

$$x=\frac{-b\pm\sqrt{b^2-4\,ac}}{2a}.$$

The principle here explained might sometimes prove useful in the discussion of equations of an even degree higher than a quadratic. Thus a pair of factors of

$$x^{2n}+ax^{2n-1}+bx^{2n-2}+cx^{2n-3}+\ldots.+k=0,$$

being, by that principle,

$$x^{n}+\tfrac{1}{2}ax^{n-1}\pm\sqrt{\left\{(\tfrac{1}{4}a^2-b)x^{2n-2}-cx^{2n-3}-\ldots.-k\right\}}$$

it follows that no real value of x is admissible, as a root, which is such as to render the expression within the brackets negative.

If the second term of the equation be absent, the factors may be written

$$x^{n}+\tfrac{1}{2}bx^{n-2}\pm\sqrt{\left\{-cx^{2n-3}+(\tfrac{1}{4}b^2-d)x^{2n-4}-\ldots.-k\right\}}.$$

Let the equation be of the fourth degree,

$$x^4+bx^2+cx+d=0,$$

then the expression within the brackets would be

$$-cx+\tfrac{1}{4}b^2-d,$$

so that no value of x, which renders this negative, can be a real root of the equation: and the knowledge of this circumstance might save us the trouble of narrowly scrutinising certain doubtful intervals in the analysis of equations.

After my former short paper was despatched to this Journal, I observed that, at p. 134 of the *Philosophical Magazine* for February last, Mr. Cockle has applied, to a certain expression, a mode of decomposition which is virtually the same as that, considered under a somewhat more general aspect, in the paper alluded to; and I send the present brief communication to the *Mechanics' Magazine*, mainly for the purpose of creating an opportunity for making this acknowledgment; as I think that, whatever merit there may be in the trifle referred to, must be shared with Mr. Cockle. I may add, too, that Mr. Gompertz, in his first tract on Imaginary Quantities, also availed himself of the liberty of introducing an arbitrary term into a particular case of conjugate factors, long ago; but the *general* decomposition of a function into such factors, however obvious from the simple algebraic principles noticed above, had not, I believe, been exhibited previously to the paper in the *Philosophical Magazine*, for April last; in which some useful inferences from this decomposition are deduced. Since then, Mr. Cockle has communicated to me another formula of a similar character; which, as I think it deserves to be recorded, I here take the liberty of inserting; it is this,

$$\mathrm{X}-\mathrm{Y}=$$

$$\left\{\sqrt{\mathrm{X}+\beta}+\sqrt{\mathrm{Y}+\beta}\right\}\times$$
$$\left\{\sqrt{\mathrm{X}+\beta}-\sqrt{\mathrm{Y}+\beta}\right\}$$

where X, Y, and β are any functions whatever.

P. S.—In line 6, col. 2, of my last article, p. 414, the *of* should be omitted.

Belfast, May 9, 1849.

ON THE LOSS SUSTAINED BY BLOWING, IN STEAM VESSELS. BY MR. WM. SEWELL, JUN., UNITED STATES NAVY.—(COMMUNICATED BY MR. ANDREW HOW, U.S.N.)

The loss by blowing may be estimated as follows:—

It is evident, that when carrying the water in the boiler at a density of $\frac{2}{32}$, one-half is used for steam, and one-half is blown out. The part used for steam will require $1202° - 100° = 1102°$, the 100 degrees being the temperature of the water entering the boiler. The part blown out will require to be raised from the temperature of the water entering, to the temperature of the water blown out, and the quantity of heat imparted to one volume of steam, will be the heat required to evaporate one volume of water, to which must be added the heat imparted to the water blown out during the same time.

Let H represent the sum of the sensible and latent heat; D = difference of temperature between the water entering and leaving the boiler; T = the temperature of the water entering the boiler.

Then when carrying the water at

$\frac{2}{32}$ $\frac{(H-T)+D}{D}$ = the part of the heat lost.

When carrying the water at $\frac{3}{32}$, then two parts will be used for steam, and one part blown out, then $\frac{(H-T\times 2)+D}{D}$ = the heat lost.

When carrying water at $\frac{4}{32}$, three parts will be used for steam, and one part blown out; then the formula will be $\frac{(H-T\times 3)+D}{D}$ = the part of the heat lost. And so for every other density. The above formula does not take any account of the heat lost by radiation, &c. The following is the loss by blowing at the different degrees of saturation named and calculated by the above formula:—

At $1\frac{3}{4}$	....	14·8	per cent.
2	....	11·5	,,
$2\frac{1}{4}$	....	9·4	,,
$2\frac{1}{2}$	....	8·01	,,
$2\frac{3}{4}$	....	7·01	,,
3	....	6·2	,,
$3\frac{1}{2}$	....	4·9	,,
4	....	4·2	,,
5	....	3·2	,,
6	....	2·55	,,
7	....	2·1	,,

These results do not take into account the specific heat of the brine, which is, I believe, ·85, which would render the losses in the proportion ·85 to 1·00.

The temperature of the water used for condensation would have some influence in the loss by blowing, as the colder the water used for condensation the less the loss will be, because the steam uncondensed will be fresh water, and the proportion of which will be greater, the less salt water is mixed with it; for instance, if the temperature of the water be such as to require twenty times as much water to condense it as there was in the steam, then one-twentieth of it would be fresh water (or 5 per cent.) but if the temperature be such as to require 40 times as much water to condense it, as was in the steam, then only one-fortieth of it would be fresh (or $2\frac{1}{2}$ per cent.)

ON THE DESIGN OF A MARINE LOCOMOTIVE AND ROTARY MOTION IN AIR.—(SEE *ante*, PP. 393, 483.)

Respected Friend,—I perceive, by the remarks of J. MacGregor, that he considers it would be difficult to adopt my plan for constructing a marine locomotive. I am aware that there would be some obstacles to surmount; but the main question is, whether the principle itself is of any value. We have to consider; firstly, whether the rotary motion is superior to the sliding; and secondly, by what means the rotary motion could be adopted. In regard to the first, there may be more than one opinion, as some assert that, in order to propel a vessel, no power is required beyond the displacing of the water, as this is done entirely independent of friction; if that is correct, then the sliding motion is the best, inasmuch as it is the most convenient; but if the water itself offers considerable resistance, that resistance would

be more easily overcome by the rotary motion, though, in that case, it would be essential to combine strength and lightness in the construction of such a vessel. J. McGregor alludes to floating wheels of 100 feet in diameter, a size which I had never contemplated. I proposed six floating wheels, of 30 feet in diameter. Of course, these wheels would not bear a great weight, if not to be immersed more than one-sixth or one-fourth of their diameter; but neither would an aërial machine: and we would not calculate the value of such a machine by the cargo which it could carry, but by its speed; and if there would be a difficulty in constructing a very light locomotive for the water, the difficulty must be infinitely greater with aërial machines, since water is 840 times more dense than air. The plan which I have proposed for adopting the rotary motion on the water may be defective, but it does not follow that a better mode cannot be discovered, if the principle is worth anything. I do not, however, assert that the rotary motion is preferable for vessels; but the suggestions of one individual may prove oft the stepping stone to another. It is not always by treading the beaten track, that discoveries in science are made.

In my remarks on giving the rotary motion to a balloon, in order to propel it, I omitted to state, that I would place a gutta percha flange around the globe containing the gas; this flange would be fastened all round from the axis in a spiral direction, so that on the globe revolving, it would act as the screw, which I believe would tend to propel the machine in an oblique direction; but, of course, a large amount of power would be required, in order to cause it to revolve with great velocity; but according to thy correspondent's, it would be better to give the aërial machine the form of the fish: and undoubtedly that would be the best form could we imitate the power which puts the fish in motion —but the question is, whether that is possible. I think that the mechanism of muscular action is too complicated for man to imitate, and while we cannot imitate that mechanism, I do not think that we would gain much by imitating the mere form which it assumes in its operation. We might suppose that the fish moves by the aid of its fins; but I question whether that is the sole cause of its motion. The small fish called *sand-eel*—a fish resembling the herring, but much smaller—when caught alive, will, on being placed on the sand, bury itself in a few seconds, and in one minute will travel so far that it is impossible to discover it after that time, although the sand may be turned by means of sharp tools. Now, its fins could not aid it much in travelling through such a hard substance as wet sand; and I believe that the principle on which it penetrates through that substance is analogous to that on which it passes through the water, and if so, the difficulty of imitating that principle must be evident. In the construction of the steam horse the rotary motion has been adopted; and, indeed, no engineer would think of taking the living quadruped as a model, and yet, by adopting a different principle, the steam horse outstrips the fleetest racer. I therefore question whether success can be attained in aërial navigation by imitating the motion of the fish or the flight of the bird. We must, I believe, look for perfection in locomotion in another form.

According to the theory proposed by T. Moy, on the motion of the planets, no power would be required to whirl them in their orbits: possibly his theory is correct; but I would have supposed a vacuum can only represent inaction; motion must, I presume, be the result of some property of matter, although the term property, in this case, is hardly correct. I believe that matter never existed without motion; the cause of motion forming one of its elements. In order to illustrate this, I may allude to electricity, which is evidently one of the component parts of water, as by its aid the elements of water can be combined; and it appears that in producing electricity by means of the battery, the amount obtained is exactly in proportion to the quantity of water decomposed. In like manner, we may suppose that the removal of the cause of motion would be equivalent to its annihilation. A theory somewhat similar was proposed some years ago by T. Pasley, a gentleman well known to thy readers; the principle of motion he termed medium of space, but he took a view of the matter which I could not exactly comprehend; he supposed the medium of space to be the cause of motion, and yet supposed that

it is one of the elements of oxygen; that gas being, in his opinion, a compound body, or a compound of nitrogen and medium of space; and he supposes that oxygen is frequently converted into nitrogen by losing its medium of space; but if the medium of space is the cause of motion, how could it be separated from any substance without entirely changing its properties as matter? Or how could it form one of the component parts of any particular substance? I do not think this was ever explained. I think that the medium of space is the medium by which matter is acted upon, being the cause of those various phenomena which cannot be produced apart from matter, and yet appear distinct from it in their operation. But, of course, merely to suppose the existence of a principle of motion does not explain the mode in which it operates in causing the motion of the planets in their orbits, and it was in allusion to this difficulty that I said some modern Newton might trace the cause of the motion of the planets, in connection with some power, formerly known by the name of *central heat*. But although I believe that the principle of motion exists in the planets, the sun, as the centre of the system, must act to a very considerable extent on those bodies, as there is evidently a link between the whole; an almost direct proof of which is that the planets nearest the sun are the most dense. The power which causes that link has been termed attraction; but this is a misnomer; we might with equal truth call it repulsion; in fact, it is neither; which is evident when we consider the nature of that power which keeps the comets in an eccentric orbit. One name is, however, as good as another, while we remain in ignorance of the nature of that power and its mode of operating.

In a work on the motion of planets, lately published, the author attempts to prove that the sun is not matter, but a mass of electricity, which, by its attractive and repulsive power, acts on all the bodies within its range; but I do not know how he accounts for the motion of the moon round the earth, as it seems to prove that the power which exists in the earth is analogous to that of the sun. At the same time, I have no doubt but that the matter of the sun is of a very different nature to that of the other planets, although there is evidently a link between the whole.

In concluding these observations, I may remark that I am fully aware of the difficulty of proving a theory proposed on such subjects to be right or wrong. I do not wish to dogmatize or assert, but simply to offer a few suggestions, which I believe will be received as such by thy readers.

I remain respectfully,
JOHN DE LA HAYE.

Liverpool, 6th mo, 5th, 1849.

STAITE'S ELECTRIC LIGHT.

Sir,—Taking a very great interest (scientifically, for I am in no other sense interested) in Mr. Staite's magnificent discoveries, and having for a long period felt convinced that electricity would, sooner or later, be practically applied as an illuminating power, I take the liberty of sending you, for insertion in your Magazine, a few particulars of what I saw during the past week, when, as you are no doubt aware, this matchless light was exhibited to the public from the Middlesex pier of the Hungerford Suspension Bridge for several successive evenings.

The light on each night of the exhibition was exhibited both with and without the reflector. When the reflector was used, and the beams of light sent in any particular direction, the effect was almost supernatural. The Houses of Parliament, Nelson's Column, the tower of St. Martin's Church, St. Paul's dome, the bridges, and the steamboats were rendered as conspicuous as by daylight, and when directed along the bridge itself, Hungerford Market and the crowds assembled appeared as if illuminated by a sunbeam. From the market side, it was almost impossible to look at the light, and the general observation was—"It is a sun." From my residence being within sight of the light, I had an opportunity of noting the time it was kept in action each evening, the average period being nearly three hours—quite a sufficient time to test the action of Mr. Staite's self-regulating apparatus. On Monday evening, by the courtesy of the patentee, I had an opportunity of inspecting his new perfluent battery, which was used during the exhibition; and I am in justice bound to say, its action was quiescent, free from any fumes whatever,

and that in every condition it answered fully the expectations formed of it. No nitric acid was used, as on former occasions, and no diminution of the power was perceptible after two hours continued action, that is, when I saw it, and I was informed by a workman in charge that it had been kept in action for upwards of twelve hours at a time in the laboratory, and tested by galvanometers at the commencement and termination of the experiment, and found not to have diminished either in quantity or intensity of electric energy. Indeed, I do not see how it could be otherwise, the very principle of its construction being to keep the exciting fluid (dilute sulphuric acid) at an equal strength by a constant "feed," the saturated solution being discharged in an equal quantity at the other extremity of the trough. I do not know whether the patentee will thank me or not for making these particulars known, but as I have communicated nothing more than what is to be seen in his specifications, I apprehend I shall not be charged with a breach of confidence. I may observe here, that I am quite satisfied the *economy* of the system will bear the strictest scrutiny. I do not feel justified in anticipating Mr. Staite by any premature disclosures on this head; but I may say, without fear of censure, that it is the cheapest light ever yet produced, and this I have had the means of ascertaining for myself.

I congratulate Mr. Staite on these most successful trials of his new light. He is the first and only man who has constructed *a self-regulating lamp, and a self-sustaining, cheap, and manageable battery* on which any dependence can be placed for long-continued action. I enclose my card, and remain, yours, &c.,

AN OLD PROFESSOR.

London, June 5, 1849.

[We can corroborate many of the statements made by our esteemed correspondent, having personally witnessed some of the exhibitions alluded to. The light appeared to us, for all practical purposes where light on a large scale is required, as being nearly, if not quite perfect.—ED. M. M.]

SUGGESTIONS FOR THE FORMATION OF MORE CORRECT METEOROLOGICAL TABLES. BY DR. BAGOT.

(*Being the substance of a Paper read before the Royal Dublin Society, May* 20, 1849.)

The importance of correct meteorological tables is so generally known and appreciated, that I need not enter on the subject; I rather wish to bring under your notice some of the difficulties which lie in the way of attaining so desirable an object. Not only to medical men, but to agriculturists and others, is it an interesting study, being in fact a question of climate; to the physician it is most important in the treatment of disease; to the tiller of the land in the proper management of his crops; and, although very many attempts are at present being made at keeping a correct register of the weather, the tables which I have seen are in many points so deficient that they do not give a sufficiently accurate idea of the very changeable nature of the climate. The winds are so uncertain, their force and direction so variable, as to be scarcely credited by any who are not in the habit of observing them. The upper currents of the atmosphere also seem, as far as I am aware, entirely to have escaped observation, with the exception of the fact that their course was frequently different from the current to which we are exposed on the surface of the earth. For instance, the ashes of a volcano has been known to fall in a direction exactly contrary to that indicated by the wind. A practised eye, by attending at particular times to those currents and eddies and other curious motions among the lofty strata of the air (as shown by the clouds), will frequently be able to predict a change in the stratum next the earth, which we call the wind; and one of my objects in bringing forward this communication is to call more attention to the upper currents of the atmosphere. Though always in the habit of watching the clouds and atmospheric phenomena, my attention was more particularly directed to them during the last three years by the potato disease, which I believe may in a great measure be attributed to the long-continued drought, accompanied by intense heat, with which we were visited in the early part of the summer of 1846 and 1848, when, according to the old adage, rain would have been more seasonable:

> "A wet and windy May
> Fills the haggard with corn and hay."

Also—

> "A wet May and a hot June
> Make the farmer whistle a merry tune."

The vitality of the potato being injured, it was afterwards unable to resist the electrical influences, by which I believe they were destroyed. I may remark, that during those two years there was scarcely any blow of hawthorn. In the course of last summer and autumn I paid two visits to the King's County, and having more leisure to bestow on the sky than I could well afford in town, I made a few observations which

I will lay before you, in the hope that they may direct a greater degree of attention to a subject which requires more thorough investigation on the part of those engaged in forming meteorological tables. In the first place, I think that observations on the direction of the wind should be more frequent, not confined to particular stated hours each day, but rather that every change in the wind should be registered. I consider it also insufficient to give the quantity of rain which may have fallen in the 24 hours—it would be much more accurate to note down the quantity which falls during the prevalence of the wind in each particular point; for instance, on August 18, 1848, the wind in the morning was S.E., it afterwards changed to N.E., then went back to S.E., from thence to S., and in the evening to S.W. During the entire day there was continued rain. Again, on August 20, the wind was S.W., with hail showers, which is a very unusual circumstance. August 21.—In the early part of the day the wind was N.W., with tremendous heavy rain; later in the day, it blew S.W., with showers. Sept. 4.—7 o'clock, A.M., wind N.E.; 6, P.M., S.E. A hot sun all day; in the evening it shifted to S.W. by S., when there was a heavy shower. Those examples will suffice not only to show the exceedingly fickle nature of our climate, but the necessity of more accurately registering the constant changes in the weather, as it is evident that one or two observations of the wind and rain on those days would not be a correct record of what absolutely took place. Those evils will be remedied to a certain extent by the use of that beautiful apparatus, the anemometer; and as science advances, I have no doubt other instruments will be invented for the purpose of registering the weather; and perhaps at some future time we may have a self-registering apparatus which will inform us of the exact hour at which a certain quantity of rain fell, and what were the force and direction of the wind at the time. I think it very probable that electro-magnetic instruments may be brought to our assistance in accomplishing this object. By observations on the upper currents of the atmosphere, much interesting information may be elicited. Clouds, as is well known, frequently pass across the sky in a direction different from the wind, as shown by a vase close to the earth, and I have frequently seen two or three such layers of vapour passing in as many different directions, some rapidly, others very slowly—and it will be found that when we had a long continuance of wind from one point, that the first and severest indication of a change in its direction will be found in the upper currents of the air, when a careful observer will find that the scattered portions of cloud seen at a great height will be impelled in a confused irregular manner, now in one direction, now in another, sometimes circularly, at another moment in an angular direction, backwards and forwards, as if several currents had met and produced a kind of aërial conflict. I have had many opportunities of investigating this very interesting phenomenon, and as I have previously mentioned, have always found it a forerunner of a change of wind. It requires a good deal of accuracy and some trouble to make this class of observation; the head must be fixed, and a small immoveable object brought between the eye and that portion of the heavens which we desire to examine. In this position the observer must watch for some time ere he can be certain of the exact direction of the clouds. During the intensely warm weather which we experienced in May and the commencement of June, 1846, when the thermometer stood as high as 84 Fahr. in the shade, the light wind which prevailed blew from many points of the compass, yet through the entire of nearly six weeks masses of cloud passed across the sky in a direction nearly from S.W. to N.E. This was by far the most remarkable phenomenon of this kind I have ever witnessed, and well worthy of record, though I believe heretofore those appearances, curious and interesting as they are, have not been more than casually alluded to by the authors of meteorological papers. A fact connected with it is curious. On one evening there was a slight shower, a short time previous to which the wind became easterly, changed to the direction from which the upper current had been passing for such a length of time, and again resumed its original position shortly after the rain had fallen. The climate of this Emerald Isle is remarkable for being particularly unfavourable to a certain class of invalids, for whom out-door exercise is absolutely essential — for instance, those affected with phthisis; but the meteorological tables as at present kept do not throw sufficient light on this subject, the fact arising not merely from the hygrometric state of the air, but also from the exceeding fickleness of the weather, the wind, as I have shown, sometimes in the course of one day, flowing from almost every point of the compass, thereby creating alternate heats and chills which are so injurious to one predisposed to disease. I hope henceforward to see more accurate meteorological tables, and that greater attention may be given to the very interesting phenomena connected with the upper currents of the atmosphere.

We took occasion some time ago (vol. xlviii., p. 612), to notice with our best commendation the highly liberal sentiments expressed by Mr. Burke, the (then) American Commissioner of Patents,* with respect to the discriminating duties in force, in regard to native and foreign applicants for patents. In Mr. Burke's Report for 1849, just issued, he enforces the argument for the repeal of these duties by the following additional observations:—

In my last annual report I had the honour to refer the attention of Congress to the expediency of placing the citizens and subjects of foreign governments applying for patents in this country, on the same ground with regard to fees which our own citizens occupy. Deeming the matter of much importance to the interests of this country, I feel it to be my duty again to bring the subject to the consideration of that honourable body.

At present, the subject of a foreign government who applies to this office for a patent is required to pay the sum of 500 dollars, if a subject of Great Britain, and 300 dollars if the subject or citizen of any other foreign power, before his application can be received, while the American citizen is required to pay only 30 dollars. It is true that the fees and duties required in most foreign countries are very much higher than those which our laws demand, but they are imposed on all alike, whether subjects or foreigners.

But even if it were just to make a discrimination in favour of American citizens with regard to fees for patents, I am of the opinion that the policy is injurious to the interests of this country, and therefore not expedient. There are in foreign countries many valuable inventions and improvements which are used in secret, for the very reason that the inventors are not able to pay the enormous duties required by their governments for the security of a patent, or are fearful they will not be protected if they were patented. And many of those inventions would find their way to this country, if their proprietors could introduce them without being burdened with a heavy tax at the outset before they could try the experiment of their success.

In my judgment, if the foreigner were placed upon the same equal footing with the citizen with regard to the fees charged upon his application, it would result in a large addition to our stock of useful and valuable inventions and improvements, and better enable our artisans and mechanics to compete with their rivals of other countries. This consideration alone should outweigh the value of the insignificant revenue, amounting each year to but a few thousand dollars, which is now derived from foreign applications.

Nor would it at all interfere with the rights or interests of the American inventor. The competition of invention is not that which arises from the production of the same descriptions of fabrics, but it exists in a proud and honourable rivalry of efforts to produce new things, which do not interfere with each other, but which are accessions to the stock of invention and art already known and in use. The field of invention is as illimitable as the world of mind and matter, and is now but just beginning to be cultivated. There, is, therefore, ample room for all explorers after the valuable treasures which yet in rich abundance lie hidden and undeveloped in its bosom, and which will require the thought and labour of ages to discover and reclaim for the uses of mankind.

I am therefore deeply impressed with the belief that the interests of this country would be greatly promoted by encouraging, through the instrumentality of a liberal system of legislation, the inventors and improvers in the arts of other countries to come here with the productions of their genius and labour, and seek a reward by introducing them into use.

In the patent system of most countries, encouragement is offered for the introduction of foreign inventions which have never before been introduced, by granting to such persons as may be at the expense, and sometimes danger, of procuring a knowledge of them abroad, and importing them into their native country—a description of patents called "patents of importation." Those patents secure to the introducer of a foreign invention rights and privileges similar to those which are enjoyed by original inventors.

Our system contains no provision for the granting of patents of importation; yet, in my experience in the office of commissioner, many instances have come to my knowledge where justice and public interest required such a reward to enterprising persons who had obtained a knowledge of valuable inventions abroad, which had not been introduced and were not known in this country.

* Mr. Burke has since given place, under the administration of General Taylor, to Mr. Ewbank, the well-known author of the admirable work on Hydraulics.

Recently an enterprising citizen of this country applied to the undersigned to know if there was a legal mode of protecting him for a limited period in the enjoyment of the art of manufacturing Russian sheet iron, the secret of which he alleged he had obtained. As there was no provision of the existing laws which applied to his case, he was referred to Congress as the only department of the government which could grant him the protection and reward which he claimed.

The secret, which he alleged he had obtained, is a most valuable one, and I believe is known only to the Russian manufacturer of the article. Its introduction into this country would contribute more to our national wealth than hundreds of ordinary inventions made at home; and, therefore, in my opinion, the importer was eminently worthy of a reward in the form of a patent securing to him the exclusive enjoyment of it for a limited term of years.

Legislation reaching such cases would certainly be founded in wisdom and good policy. Ample provision could be made against fraud or imposition when patents are applied for to protect imported inventions. The importer of the new art or manufacture should, as the inventor now is, be required to disclose his secret, and a rigid examination should be made into its novelty in this and other countries, as is now made with original inventions, before a patent of importation is granted. By such provisions and guards the new feature proposed may be safely introduced into our patent system.

CANDLE WICKS.

Sir,—Permit me to say a few words in reply to your correspondent, "A. H.," page 737 of your last Number, respecting placing the wicks of candles on one side. I have occasionally burnt common dips, with cotton wicks, of about 10 or 12 to the pound (kitchen candles), in place of rushlights, in the bed-room when the latter have not been at hand. I place the candle itself at an angle with the horizon of about 45° or 50°: set it, with the candlestick, where it may be protected from draught, and it will burn to the last particle of tallow, without snuffing or guttering, or requiring any attention (of course, if occasion occur for removing it, the candle should be set upright for the time). By this plan, the constant trouble of placing the wick on one side is avoided. I have not been equally successful with larger candles.

The wicks of Palmer's patent candles, and some others, always preserve the required inclination during combustion—the latter being so good, that the wasted ashes are almost imperceptible.

I am, Sir, yours, &c.,

E. V.

Dorchester, June 5, 1849.

DAVIES'S ROTARY ENGINE.—NOTE ON "A. Z.'S" LETTER (SEE *ante*, P. 509.) BY MR. DREDGE.

Sir,—"A. Z." evidently founds his argument on the assumption that each piston subtends an area of 60° on both sides of the line of centres, which is by no means warranted from anything he has either read or heard in reference to the engine in question. In the single engine, it is true, the piston subtends an area of 120°; but if "A. Z." will refer to the diagrams which were published with the specification, he will see that when two pistons are attached to one cylinder, they do not extend over more than 60° each, or about 30° on each side of the line of centres; and, as the pistons in the two cylinders are set at right angles to each other, it follows that all the ports are open for the admission of steam four times in each revolution during the time the piston is passing through the arc of 30°. And it thus happens that the spaces pointed out by "A. Z." as dead points, are the only spaces in which the whole of the pistons are in effective operation *at the same instant*.

I am, Sir, yours, &c.,

WILLIAM DREDGE.

London, 10, Norfolk-street, Strand,
May 29, 1849.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 7TH OF JUNE.

JOHN HENDERSON PORTER, Adelaide-place, London Bridge, engineer. *For an improved mode of applying corrugated iron in the formation of fireproof floors, roofs, and other like structures.* Patent dated December 2, 1848.

Two or more plates of corrugated iron are riveted together, with the corrugations of the one placed opposite to the corrugations of the other, so as to form a series of hollow joists or beams; and in the case of being used in the place of rafters to support a flooring, the spaces between the corrugations are filled with concrete. These plates may be employed in a vertical, horizontal, or inclined position, and may have the form of the corrugations varied according to pleasure.

Claim.—The application of corrugated

iron in the formation of fire-proof floors, roofs, and other like structures.

ROBERT NELSON COLLINS, Oxford-court, Cannon-street, druggist. *For certain improved compounds for the prevention of injury to health under certain circumstances.* Patent dated December 2, 1848.

A substance containing chlorine is to be combined with some alkaline substance, the base of which has less affinity for the acid than the chloride, so that when moistened or mixed with water, chlorine gas may be evolved therefrom; and this compound is to be employed as a disinfecting agent in cesspools, slaughter-houses, &c.

The materials which it is stated are to be preferred for this purpose, are chloride o lime and sulphuret of alumina, mixed together in the proportion of one to two. The compound is to be packed in close vessels until required for use.

Claim.—Combining together certain substances to form a compound which shall possess the property of evolving or liberating chlorine gas, and as applicable to the prevention of injury to health under certain circumstances.

JOHN DULEY, Northampton, iron founder. *For certain improvements in the construction and arrangement of stoves for cooking and other purposes.* Patent dated December 2, 1848.

Claims.—1. The raising or lowering the bottom of grates by means of two rack bars and pinions.

2. The arrangement of two moveable flaps and a blower, by a suitable disposition of which the stove may be made to open or close, and the products of combustion allowed to pass directly to the chimney, or compelled to pass through flues first.

3. A mode of heating an oven, which consists in causing the flame and smoke to pass around it and through a hollow central shaft.

4. Heating and ventilating an oven by causing currents of air to pass into the interior thereof.

THOMAS DRAYTON, Regent-street, practical chemist. *For improvements in silvering glass and other surfaces.* Patent dated December 2, 1848.

The patentee proposes to silver the surfaces of glass and metal by means of a solution composed of 1 oz. of hartshorn or ammonia, 2 ozs. of nitrate of silver 3 ozs. of water, and 3 ozs. of spirit (by preference, spirit of wine.) This mixture is allowed to stand for three or four hours, and then filtered, after which ½ oz. of saccharine matter (by preference, grape-root sugar), dissolved in half a pint of spirit and half a pint of water, is mixed with every ounce of the filtered fluid. The glass is heated to 160° Fah., and a quantity of the fluid poured upon it. When the silver is deposited and dried, it is to be coated with a suitable varnish, to preserve it from the effects of the weather.

Claim.—The patentee does not confine himself to the precise details so long as the peculiar character of the invention is retained, whereby silver is deposited on surfaces by means of a solution of that metal, without being previously coated or the use of oil.

ROBERT BURN, Edinburgh. *For an improved roller gin used in separating the seed from cotton.* Patent dated December 2, 1848.

This improved roller gin consists of a framework which carries an endless band for feeding in the cotton between a wooden and a steel roller, the bearings of which are of steel, and made adjustable. Upon the other side of the rollers a brush-fan is made to revolve, whereby the separation of the seed from the cotton is effected. Motion is communicated to the different parts of the machine by means of straps and pulleys.

JOHN ARMSTRONG, Edinburgh, brass-founder, *for improvements in constructing water closets.* Patent dated Dec. 2, 1848.

These improvements consist in making the bottom of the pan curved, and adapting to the end a vertical slide valve by which it may be opened or closed as required. The space between the face of the valve and the end of the pipe is made water-tight by the interposition of a collar of gutta percha. The back of the valve is attached to a quadrant piece, hinged at top, and it has a slot in which works a stud fixed on the bottom of the handle rod, whereby it is opened or closed.

Claim.—The patentee lays no claim to the combination and arrangement of mechanical parts described, except in so far as regards the vertical slide valve, and the parts connected therewith.

FRANCIS HASTINGS GREENSTREET, Liverpool, engineer, *for certain improvements in hydraulic engines.* Patent dated Dec. 2, 1848.

The cylinder is connected at top and bottom to the valve pipe, into which the water flows from the source of supply by a central opening, by means of two nozzles fixed to each end, which are provided at bottom with two valves each, one for establishing communication between the interior of the valve pipe and the cylinder, and the other for opening the cylinder to the atmosphere. All four valves are fixed upon one common spindle, and are constructed of moveable metal discs, with a suitable number of open-

ings in them, revolving against fixed discs, furnished with corresponding openings, so that as the holes of the moveable disc come over those of the fixed one, or its surface, communication is established or shut off. These valves are, moreover, so arranged in regard one to the other, that when communication is established between the interior of the cylinder above the piston and the valve pipe, communication with the atmosphere on that side will be cut off, while communication between the interior of the cylinder beneath the piston and the valve pipe is cut off and established between it and the atmosphere. The reciprocating, or partial rotary motion of the valves, whereby their action is reversed, is effected by means of a weighted lever turning loosely upon the end of the valve spindle and working in a slotted guide piece. The lever is made to travel at every stroke of the piston from one end of the guide to the other by the action of a slotted diagonal piece, to which a length of stroke equal to that of the piston is communicated. The end of the spindle is also fitted with a collar having a slot cut on its periphery, into which takes a pin fixed on the inside of the lever.

Claim.—The combining and arranging four distinct valves connected by a spindle, or series of jointed rods, as the case may require, so that the pressure upon the back of one valve shall be counterbalanced by that upon the other, and also, so exactly proportional, as that, when the valve, communicating with the head of water shuts, the corresponding one opens, so that the flow of water is not suddenly arrested, whereby concussion is prevented, and merely the flow of the current of water is directed to opposite sides of the piston.

Frederick Collier Bakewell, Hampstead, gentleman. *For improvements in making communications from one place to another by electricity.* Patent dated December 2, 1848.

These improvements refer, firstly, to apparatus for producing copies of printed or written characters or symbols at distant places, and to an arrangement for throwing one or more stations out of circuit, and bringing the required station into circuit.

The copying apparatus consists of a transmitting and a receiving cylinder, which are constructed as much alike as possible, and are made to revolve at equal speeds by means of clockwork. Both cylinders are suspended horizontally in suitable bearings, and have each a worm screw parallel to and revolving with them, which carries an arm fitted with a style or point that rests upon the periphery of the cylinder. The message is written or printed with varnish, or other non-conducting substance, on tinfoil, which is wound round the transmitting cylinder, so that the lines of words may run round it. The style of the transmitting apparatus is connected to one pole of the battery, and its cylinder to the style of the receiving apparatus. A sheet of paper, saturated with a solution which is easily decomposed by the passage of electricity, so as to cause a black mark, is wound beneath the style on the receiving cylinder, which is connected with the other pole of the battery. The speed of the cylinders may be varied; but, it is stated that they should be caused to make six or seven revolutions to each line of writing, in order that the letters may be distinctly and legibly formed. It will be readily understood, from the above description, that the style of the receiving cylinder, in traversing from one end to the other of it by the action of the worm screw, will trace a number of lines upon the saturated paper, except when the electric current is intercepted by the passage of the non-conducting substance with which the letters are written or printed, between the style and cylinder of the transmitting apparatus, so that the characters will be formed by the absence of the black lines.

In order to ensure the synchronous and continuous movement of the cylinders, the patentee employs an electro-magnet, the keeper of which is fitted with a bent arm that catches against the projections upon the periphery of a disc, keyed on the axle of the transmitting cylinder. The action of this regulating electro-magnet is rendered intermittent, by causing the exciting current from a voltaic battery to pass previously to a pendulum, which is furnished with two platina points, which at each vibration come into contact with one or other of a pair of platina points fixed on the ends of a prong, whereby the electric current is cut off or communicated to the regulating electro-magnet, and the action of the bent arm on its keeper rendered alternating. The starting apparatus consists of a small magnet, which is supported on the same side of the cylinder as the clockwork, and opposite to the regulating magnet, and is excited by the passage of the current from the cylinder. The keeper of this magnet is furnished with a bent arm which catches against a fan.

To ascertain if the movement of the apparatus is synchronous, a small strip of paper is wound round the cylinder, on which, when the speeds are equal, a regular line will be traced; but when unequal, the line will be irregular, and the operator consequently enabled to adjust the apparatus so as to obtain the synchronous and continuous

motion required. Instead of one style for each cylinder, any convenient number may be employed, each isolated from the other, and fitted with separate wires having their other ends inlaid in an ivory disc, so as to be also isolated from each other. Another disc, fitted with a point, in contact with the ivory disc, is made to revolve rapidly. The electric current is transmitted through this point, and thereby communicated to the wires and the styles successively.

The second part of the invention is proposed to be effected by one or other of the following arrangements.

At each station there is a magnetic needle, which is deflected by the action of the primary current passing along the main wire, either to the right or to the left, by the reversal of the poles, as is well understood, so as to come into contact with two platina points connected by wires to a voltaic battery and to an electro-magnet. The magnet is connected with the battery, and is excited in consequence of the electric circuit being completed by the contact of the magnetic needle with the platina-pointed ends of the wires. The keeper of this magnet is furnished with a detent, against which rests one of two teeth attached to the periphery of a wheel which is made to revolve once in three or more minutes. A wire leads from the main wire to the telegraphic apparatus, and thence to a spring in contact with the periphery of the wheel, across which the current passes to an opposite and similar spring connected with a wire leading to the ground, to complete the circuit between the first and second station. Precisely similar arrangements are adopted for every station. To bring a distant station into circuit with another, say, the first, and to throw the intervening ones out of circuit, the operator deflects the needle, and prevents the wheel from turning. The needle of the second station is deflected by the passage of the primary current, and the electro-magnet excited, whereby the detent will be withdrawn, and the wheel allowed to revolve so as to interrupt the communication between the main wire, and the earth, and thereby to prevent the return of the current. The effect will be to throw this station out of circuit, and to bring the next succeeding one into circuit. The operation is then repeated until the required station is brought into circuit. A concerted signal is then made to indicate that that is the station to be communicated with, and the operator there, prevents the wheel from further action, and signifies that the signal has been understood. The message can then be transmitted.

The other two arrangements are mere modifications of the preceding for communicating with one or two branches, and are carried into effect by placing at the point of junction a wheel fitted with apparatus similar to what has been before described, which has one portion of its periphery composed of a non-conducting substance. According as it is desired to cut off or establish the circuit between the main wire of the transmitting station and its continuation, or the branch wire, the non-conducting or conduction portion of the wheel is brought into contact with the end of the wire belonging thereto.

Claims.—1. The general arrangement of apparatus for producing copies of written or printed characters at distant places by the agency of electricity.

2. The use of a concerted mark to serve as a guide for regulating the speed of electro-telegraphic copying apparatus at distant places.

3. The mode of obtaining synchronous and continuous motion by means of regulating electro-magnets, with or without the use of pendulums.

4. The method of breaking the circuit by means of local electro-magnets and voltaic batteries, acted on by the deflection of a magnetic needle by the transmission of the primary current, and the mechanism for renewing the current.

JOHN DAVIES and GEORGE DAVIES, Albion Foundry, Staffordshire, iron founders. *For improvements in steam engines.* Patent dated December 2, 1848.

The improvements sought to be secured under this patent are as follows:—

1. A mode of converting rectilineal into rotary motion, by supporting the crank pin in brasses which slide in the crosshead of the piston. The brasses, as they wear away, are to be screwed up tightly, and the piston is made to pass through the crosshead and give motion to the piston of a blowing machine.

2. The rectilineal motion of the piston of a blowing machine is converted into a rotary one, and communicated to a shaft by means of a rod keyed loosely to the end of the piston rod of the blowing machine, and passing through a sliding stuffing-box in the side thereof. The other end of the rod is connected to the crank pin.

3. The steam induction and eduction ways, both at the top and bottom of the cylinder, are each worked by two valves fixed on the same spindle, which are constructed of slightly different diameters, so that the pressure to be overcome is that due to the difference in the diameters.

4. The same principle is proposed to be applied to the construction of valves in the feed-pipes of steam boilers.

5. The apparatus for working the dampers

consists of a pipe communicating with the boiler, and closed at top by a valve, which is weighted at less than the safety valve. Above the valve is placed an inverted vessel, which is connected at top to the damper, and is fixed in equilibrium with the sides dipping into the water contained in the exterior casing of the steam-boiler pipe. This casing is provided with an overflow pipe. It follows that when the valve is opened by the increased pressure of the steam, the inverted vessel will be lifted up, and the dampers partially or wholly closed. When the valve is closed, the inverted vessel will descend into its first position.

Claims.—1. The mode of fixing the cross-head to the piston, so that it may pass through it and give motion to the piston of a blowing machine. Also, the use of the brasses.

2. The arrangement for converting rectilineal into rotary motion.

3. The mode of working the steam valves.

4. The method of working the feed valves of steam boilers.

5. The mode of working the dampers.

William Young, of the firm of Henry Bannerman and Sons, Manchester, merchants. *For certain improvements in machinery or apparatus for winding, balling, or spooling thread, yarn, or other fibrous materials.* Patent dated December 2, 1848.

Claims.—1. An arrangement and construction of self-acting machinery for balling or spooling yarn, worsted, or other fibrous materials, at one and the same operation.

2. Certain arrangements and construction of self-acting machinery for winding cotton, thread, &c., on to several bobbins or reels in the same machine.

George Armstrong, Newcastle-upon-Tyne, Esq. *For certain improvements in steam engines.* Patent dated December 2, 1848.

These improvements consist—

1. In a means of maintaining an equal pressure between the steam acting in the cylinders of steam engines and that lodged in the cavities of the piston, in order to prevent the packing rings from being alternately subjected to a force tending to thrust them inwards or to press them unduly outwards.

2. In a means of preventing injurious shocks to the piston cranks and cylinder covers of steam engines, in consequence of the accumulation of water in the steam ways and clearance spaces.

3. In the application to locomotive steam engines of the varieties of steam boilers in which the flues are composed of small tubes placed in an upright position; and

4. In a novel construction and arrangement of the various parts of the locomotive steam engine, and in a mode of creating the draught from the fire through the flues.

Mr. Armstrong's new locomotive steam engine is constructed with a quadrangular boiler, placed behind the driving wheels, with vertical flues passing through the top of it, whence the products of combustion escape through two chimneys. The two vertical opposite sides of the boiler are stayed by transverse iron bars attached thereto, and passing between the rows of flues. The draught from the fire is promoted by two steam jets, one to each chimney, attached to a pipe leading direct from the top of the boiler, and is further increased by placing swivelled annular plates in the chimneys, just above the steam jets, whereby (when fixed horizontally) the space will be contracted, and a down current of air prevented. The ordinary dampers are fixed between the annular plates and steam jets, which are regulated by any suitable apparatus employed for a similar purpose. The steam is gathered in through narrow openings in two collectors placed close to the top of the boiler, and in opposite angles of it, so that the steam may be taken from the points remotest from ebullition, and equally from the whole surface of the water. These collectors communicate with one another by a steam way, which opens into a pipe that conducts the steam into an "equalizing vessel" placed beneath the level of the bottom of the boiler, and between it and the cylinders, which are placed in the forward part of the frame. This "equalizing vessel," which has an effect analogous to that of an air vessel in regulating the flow of water in pipes, serves to regulate the supply of steam through another pipe to the cylinders, by either retaining the excess or furnishing the deficiency which may occur, and, consequently, prevents priming. The steam cylinders are horizontal, and cast in one piece, in order that they and the centres of the cranks may be as near the centre of the engine as practicable. The feed pumps are worked by eccentrics on the driving wheels, and are, together with the reversing gear, &c.; placed outside the frame. The reversing gear is worked by a screw through the intervention of levers and rods. The space between the boiler and cylinders is covered over for the engineer to stand on, and extends round the boiler on either side, to allow of communication with the tender. The flooring has traps in it to allow of ready access to the working parts beneath. Above the steam cylinders are two other cylinders, which contain the steam induction and eduction valves, which are keyed on the same spindle. The steam is admitted between

them, and, according as they move backwards and forwards by the eccentrics, it is admitted into and exhausted from either end alternately. The packing of the piston is composed of a steel ring, with a tongue of leather placed over the spit, to prevent the entry of the steam, and is kept distended by steel springs placed behind. The piston has a central hole, fitted with a ball-clack valve for admitting the steam behind the packing ring without allowing it to escape, so as to maintain an equality of pressure between it and that in the cylinder, and thereby prevent the packing ring from being unduly forced one way or the other, either by the springs behind it or the steam in the cylinder. Within the passages of the valve cylinders are placed "relief valves," which are kept closed by the pressure of the steam, but which open when the water accumulated in the clearance spaces is more than they can conveniently contain, and allow it to escape. The steam and valve cylinders are in a casing. The feed water is pumped from the tender over small tubes, through which the waste steam escapes into the atmosphere.

Closed tubes are screwed to the boiler to receive the still water and sediment which will be deposited therein. These tubes are occasionally unscrewed and emptied of their contents.

Claims.—1. The application to the pistons of steam engines of a ball clack valve, or other valve of an analogous nature, for the purpose of admitting steam behind the packing rings, to maintain an equality of pressure between it and that acting in the cylinder, and thereby prevent them from being unduly forced inwards by the latter, or outwards by the steel springs.

2. The application of "relief valves" to steam cylinder valves, to allow the escape of any excess of water beyond what the steam ways and clearance spaces would contain.

3. The application to steam engines of "upright tubular boilers" of any other than a cylindrical form.

4. The application to steam engines of "upright tubular boilers" with the upper part wider than the lower.

5. The employment of the "steam collector" placed near the top of the boiler, in order to gather the steam from the remotest point of ebullition.

6. The use of the "equalizing chamber" for the purpose of equalizing the supply of steam to the cylinders, and thereby prevent "priming."

The following claims embrace the improvements when applied to locomotive steam engines:—

7. Placing the steam boiler behind the driving wheels.

8. Casting the steam cylinders in one piece.

9. Placing the working parts between the boiler and the cylinders.

10. The employment of screw power to work the reversing gear.

11. The injection of jets of steam direct from the boiler into the chimneys for the purpose of creating a draught.

12. The mode of heating the feed water by the waste steam from the cylinders, and the adaptation of steam valves to the cylinders.

13. The application of closed vessels to steam boilers to collect the sediment.

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal.*]

For an Improvement in Connecting Pumps with Hydraulic Presses or Rams. *Robert Dillon.*

The patentee says,—"The nature of my invention consists mainly in the combination of two or more valves, loaded to minor pressures with the common lever used on horizontal pumps, the same being for the purpose of disconnecting one or more of a set of such pumps, to which they are attached, from the press, and by this means concentrating the driving power in a constantly diminishing number of pumps, as there is necessity for it; and finally, combining the entire driving power to such pumps as are loaded to the maximum pressure required."

Claim.—"What I claim as my invention is, the valves introduced into and combined with the discharge pipes of hydraulic force pumps, and with the safety valve levers of the same, in the manner set forth, for governing the action of said pumps when operating upon the hydraulic ram; and this without confining myself to the precise position or number of said pumps or valves, as placed within the discharge pipe, provided the results produced are the same."

For an Improvement in Raising Tilting Pumps. *John J. Vedder and Henry Vine.*

The patentees say,—"The nature of our improvement consists in attaching a flat guide-piece to the rope to which the bale of the bucket is attached; said guide-piece being made to pass through an opening in the stationary frame, so as always to present that part of the rim of the bucket which is at right angles to the bale to the canting hook—a difficulty that has heretofore prevented the use of a single rope with a bucket and canting hook, in consequence of its liability to turn and not present itself properly at the canting hook, to remedy which defect

resort has been had to a double rope, which is both expensive and inconvenient."

Claim.—"What we claim as our invention is, the employment of the flat tempered bar and the guide, as set forth, for presenting the bucket properly to the canting hook when one rope or band only is used, substantially as set forth."

For an Improvement in Air-Heating Furnaces. *John Barker.*

The patentee says,—In my improved air-heating furnace, instead of erecting a single brick wall and arching it over, I erect two walls, both of which are arched over, leaving a space, say of an inch or two, between the two walls and arches, which space being occupied by a bad conductor of heat, (atmospheric air,) has the effect of keeping the outer wall and arch at a low temperature, which not only economises the heat, but allows of the ready descent of the cool atmospheric air on the outside of the outer wall, which air is to pass down between it and the walls of the apartment in which the furnace is situated, and is to enter the heating compartment through openings at the lower part of the walls, as in the structure described in my original patent.

Claim.—What I claim as new is; first, the enclosing of the air-heating chamber within a double arch, in such manner as to admit of the entrance of a stratum of cool air between such arches and their sustaining walls, said air being made to descend in the manner set forth, between the walls of the outer arch and those of the enclosing compartment. I also claim the manner of arranging the pipes, so as to cause a current of cold air to be brought into contact with the former by means of the latter, as described. I likewise claim the manner of employing the pipe for causing a lateral current of air to pass over the top of the stove, in combination with the openings for the introduction of said air, under an arrangement and combination of parts the same with that made known.

For an Improvement in Window-blind Fasteners. *John Welsh.*

The patentee says,—"My improved apparatus for opening, closing, and securing shutters, consists of a sliding toothed rack, which is straight, and passes through a mortise in the window frame, and of a toothed segment wheel or pinion, made fast to the bottom of the shutter or blind, in such manner as that its centre shall coincide withth e centre of the joint pin of the hinge or hinges of the shutter. The sliding rack I provide with a hinge joint, by which it is enabled to fall down against the window frame, so as not to project into the apartment when the shutter is opened; it has, also, through it a number of holes, into which a pin or bolt may be passed, to secure the shutter when opened or closed, or to hold it partially open at different distances. A pin rising from the window sill and passing through the centre of the wheel, may constitute the lower hinge of the shutter, or, where the shutters have been already hinged, the toothed wheel or pinion, properly centred, may be made fast to the bottom of the shutter, the ordinary hinges both remaining in place."

Claim.—"What I claim as my invention, is the manner set forth, of employing a straight rack and a segment wheel, for the opening and closing of shutters, in combination with so constructing said rack, as that it may be turned down at the inside end in the manner made known, and that it may be made to hold the shutter in any desired position, by means of a bolt or pin as described."

For an Improvement in Lead Pipe Machinery. *Isaac Adams.*

Claim.—"What I claim as my improvement, is the combination in which the core is sustained by pressures on opposite sides of it, and the mandril: meaning to claim the said combination, whether a double cylinder and two pistons, or two or more cylinders and as many pistons, are employed in it to act with respect to the mandril, core, and die placed centrally between them substantially as set forth; the said combination enabling me to entirely dispense with a bridge for supporting the core, and a construction chamber applied to said bridge, for the purpose of uniting the metal after its separation by the said bridge, and previous to its passage between the die and core. The aforesaid arrangement and combination enables me to obtain a short, substantial, and unvarying mandril; also one general and undivided passage for the pipe material to and through the die—the material in my machine being, at no time in the operation, disconnected so as to require re-uniting. It also renders unnecessary the hollow ram, which is used in some machines to keep the mandril in place."

For an Improvement in Propellers for Vessels. *J. Smith.*

The patentee says,—"The nature of the first part of my invention consists in combining with the paddle wheels, constructed in any desired manner, and placed at the sides of the vessel, a propeller or propellers placed at the stern of the vessel, the axis of which to be parallel (or nearly so) with the keel of the vessel, so that the vessel shall be impelled by the joint action of the propeller or propellers at the stern and the paddle-wheels at the sides; such joint action having

the effect, as shown by experiment, to impel the vessel with greater velocity and more steadily, with a given force, than by the action of the paddle-wheels or the propeller or propellers separately. And the second part of my invention consists in placing the paddle-wheels, when used in combination with the propeller or propellers at the stern, forward of the centre of gravity of the vessel, that a portion of the action of the paddle-wheels thus placed may have the effect to partly lift the bow of the vessel, while the propeller or propellers at the stern exerts all its action to impel the vessel forward. The paddle-wheels for the sides, and the propeller or propellers for the stern, may be constructed in any of the known and approved forms, as this makes no part of my invention."

FOR AN IMPROVEMENT IN THE MANUFACTURE OF SPOONS. *Robert Wallace.*

Claim.—"I do not claim the strengthening of the spoon handles by the enclosing therein either a wire or flat piece of tin, or other metal, the latter mode having been used by me in years past, and found not to answer the purpose; but I do claim as my invention the enclosing in the centre of the handle of a spoon, for the purpose of strengthening the same, a strip or piece of tin plate, or other suitable metal, in concave, grooved, or tubular shape, or in any shape whereby one or more edges of the said strip or piece will be made to resist the up-and-down strain of the handle, said strip or piece having been first formed or shaped by a drop in suitable dies or otherwise, and curved to suit the bend of the handle, all in manner and substantially as set forth."

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Goose, of Birmingham, manufacturer, for certain improved machinery for manufacturing nails. (Being a communication.) June 5.

William Henry Smith, of Fitzroy-square, civil engineer, for certain improvements in breakwaters, beacons and moorings, parts of which are applicable to other purposes. June 5; six months.

George Simpson, of Buchanan-street, Glasgow, civil and mining engineer, for a certain improvement or improvements in the machinery, apparatus or means of raising, lowering, supporting, moving, or transporting heavy bodies. June 5; six months.

Samuel Dunn, of Doncaster, gent., for improvements in constructing tunnels, and in apparatus to be used for such or similar purposes. June 5; six months.

Thomas Lawes, of the City-road, gent., for improvements in generating steam, and in the means of obtaining and applying motive power. June 5; six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in stoves, grates, or fire places, and in warming or heating buildings. (Being a communication.) June 5; six months.

Thomas Jowett, of Burrage House, in Bingley, York, stuff manufacturer, for certain improvements in the method of stopping power looms, and preventing injury to the cloth, or fabric, in the course of being woven. June 5; six months.

George Hinton Bovill, of Abchurch-lane, London, engineer, for improvements in manufacturing wheat and other grain into meal and flour. June 5; six months.

Jacques Hulot, of Rue St. Joseph, Paris, manufacturer of fabrics, for improvements in the manufacture of the fronts of shirts. June 5; six months.

Daniel Miller, civil engineer, of Glasgow, for certain improvements in the mode of drawing ships up an inclined plane out of water. June 5; six months.

Victor Hippolyte Laurent, of France, engineer, for improvements in looms for weaving. June 5; six months.

Osgood Field, of London, merchant, for improvements in anchors. (Being a communication.) June 5; six months.

A grant of an extension of her Majesty's letters patent for the term of five years from the 27th of May, 1849, to Thomas Hornby Birley, assignee of George Bodmer, the original inventor of an invention for certain improvements in machinery for preparing, roving, and spinning cotton and wool. June 5.

Thomas Masters, of Regent-street, gent., for certain improvements in the construction and arrangement of apparatus for cooking, heating, and evaporating fluids, and obtaining decoctions and infusions from certain vegetable and animal matters, parts of which improvements are applicable to certain chemical processes. June 7; six months.

Edward John Payne, of Chancery-lane, London, for improvements in marine vessels, in apparatus for the preservation of human life, and in moulding, joining, and finishing hollow and solid figures, composed wholly or in part of a certain gum, or combinations of certain gums, also for improvements in dissolving the aforesaid gums, and in apparatus or machinery to be used for the purposes above mentioned. June 7; six months.

Robert Wilson, of Low Moor Iron Works, Bradford, York, engineer, for certain improvements in steam engines and boilers, and methods of preventing accidents in working the same. June 7; six months.

Bennett Alfred Burton, of John's-place, Southwark, engineer, for certain improvements in the manufacture of pipes, tiles, bricks, stairs, copings, and other like or similar articles from plastic materials; also improvements in machinery to be employed therein. June 7; six months.

John Edward Hawkins Payne, of Great Queen-street, Middlesex, coach-lace manufacturer, and Henry William Currie, engineer, for improvements in the manufacture of coach-lace and other similar looped or cut-pile fabrics. June 7; six months.

Charles James Anthony, of Pittsburgh, America, machinist, for certain new and useful improvements in the means of treating unctuous animal matter. June 7; six months.

William Henry Ritchie, of Brixton, gentleman, for improvements in fire-arms. June 7; six months.

John Houston, of Nelson-square, surgeon, for improvements in obtaining motive power when steam and air are used. June 7; six months.

James Steel, of Horton, York, and Benjamin Emmerson, of the same place, overlooker, for improvements in power looms. June 7; six months.

Gustave Francois Picault, of Rue Dauphin, Paris, cutler, for improvements in apparatus for opening oysters. June 7; six months.

Douglas Hebson, of Liverpool, engineer, for improvements in steam engines. June 7; six months.

Henry Knight, of Birmingham, mechanical engineer, for certain improvements in apparatus for printing, embossing, pressing, and perforating. June 7; six months.

Stanhope Baynes Smith, of Birmingham, electro-plater and gilder, for improvements in depositing metals and in obtaining motive power, part of which improvements are applicable to certain other similar useful purposes. June 7; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
June 1	1910	Mc Kean, Perkes, and Co.	Liverpool	Iron house.
5	1911	Thomas Thornton	Great Carter-lane	Steam escape.
„	1912	Ransomes and May	Ipswich	Wrench or spanner.
6	1913	George Stocker	Holborn	Knife and fork cleaning machine.
„	1914	William Couch	Skinner-street	Revolving carpet brush.
„	1915	Edward Russell Beedle,	Workingham	Ventilating brick.
„	1916	Charles Alfred Tordery,	Cathedral Hotel	Parts of a stock.
„	1917	Thomas De La Rue and Co.	Bunhill-row	Envelope.

" Experimental trip on the 13th November, with the Parabolic Propeller of Mr. Hodgson.

" Rate, 7·77 knots; $87\frac{1}{8}$ piston strokes; steam, about 6 lbs. Condenser barometer, 26½ inches. Atmospheric barometer, $29\frac{5}{12}$. Wind N. N. W., blowing a light top-gallant breeze to a reefed topsail breeze. Squally weather.

" Experimental trip on the 16th November, with a two-bladed screw, the course and centre line of which is the same as the four-bladed one.

Rate, 7·42 knots; 41½ double strokes; steam pressure in the boiler, $6\frac{7}{12}$ lbs. Barometer of condenser 25⅞ inches. The atmospheric barometer, 29½. Wind N. N. W., from a variable top-gallant breeze to a calm.

" Rotterdam, the 29th November, 1847.

(Signed) " The Naval Lieutenants,
" J. WELTERBACH.
" J. L. VAN FLORENSTEYER.
" D. L. WOLFSON.
" The Engineer in the Steam-boat Service,
" D. VAN DEN BOSCH."

" In consequence of the above Report the Screw was superseded by the Parabolic Propeller on his Netherlands Majesty's ship, *Samarang*, in the month of November, 1847, with which the vessel proceeded to sea, to join the Dutch squadron at Batavia."

Extract of Minutes taken on Board the Lady Sale, *on a Voyage from London to Belfast, and back* :—

1849, April 21st., Log. 5½ knots—Engines 25 Revolutions—Ratio of Wheels 3 : 1
Ditto Screw 30 „ .

Comparative Results	Parabolic.		Screw.
Revolutions of Propeller	75 per min.	....	90 per min.
Pitch of „	8·5 feet	....	8·75 feet.
Speed of „	6·287 knots	....	7·766 knots.
Ditto of Ships .	5·500 „	....	6·000 „
Slip of Propeller . .	0·787 „	....	1·766 „ or 12½ per cent.

Being, 10 per cent. less than the Screw

April 22nd. Left Dartmouth Harbour 4h 40' A.M.
Abreast the Eddystone, 31 miles, 10·0 A.M., light breeze a-head.
Noon, Log. 6 knots—Engines 36 Revolutions. Ratio of Wheels 2·22 : 1.
Ditto Screw 45 „

	Parabolic.		Screw.
Revolutions of Propeller	79·92 per min.	....	99·9 per min.
Speed of „	6·70 knots.	....	8·62 knots.
Ditto of Ship	6·00 „	....	6·00 „
Slip of Propeller	0·70 „	....	2·62 or 31 per cent.

Being 20 per cent. less than the Screw.

The data for the Screws are as stated by the Captain of the vessel.

May 5th.—2½ A.M., Log 6 knots; Engines, 25 revolutions; Ratio of Wheels, 3 : 1. Calm and moderate swell.

Speed of Propeller 6·287 knots,
Ditto of Ship ...... 6·000 „
Slip of Propeller... 0·287 „ or 5 per cent. nearly.

May 17th.—At Long Reach:
Engines, 37 revolutions; Speed of Propeller, 6·88 knots.
1st knot 12' 10"=4·934 knots per hour.
2nd ditto 7 40 =7·832 „ „

2) 12·766

6·383 knots per hour,
and the wind a point or two on the bow the first knot, blowing hard.

The following Testimonial to the performance of the Propeller at Long Reach will sufficiently verify all its performances at sea:—

(Copy.) 3, *York-square, Stepney*, *24th May*, 1849.

SIR,

I have great pleasure in certifying the correctness of your Report on the Speed of the *Lady Sale*, when tried on the 17th inst. at the Admiralty Knot in Long Reach. The speed against tide being at the rate of 4·934 knots per hour, and with tide 7·826 knots, being a mean speed of 6·378 knots per hour, with an average speed of propeller amounting to 6·88 knots—thus showing a slip of only 7 per cent.

The form of the vessel being taken into consideration, renders this result quite unequalled, the vessel being in nowise adapted for an easy development of speed. I am, Sir, yours truly,
(Signed) JOHN DUDGEON,
Inspector of Marine Machinery.

To Mr. Hodgson.

Applications for Licenses, which will be granted during the present year at a reduced charge, to be made to the Parabolic Sub-marine Propeller Company. Address, Mr. CLARE, Solicitor, 5, Size-lane, Bucklersbury, where full particulars may be seen and References obtained.
June 7, 1849.

NOTICES TO CORRESPONDENTS.

Mr. Davies's letter in refutation of "Z." reached us too late for insertion this week. It shall appear in our next.

P. I. A.—*Previous publication of an invention invalidates a patent under all circumstances; but if it can be shown to the satisfaction of the Privy Council that, at the time of taking out a patent for an old or known invention, the new inventor was not aware of the previous publication, and that the invention was not then in general use, they will grant a confirmation of the patent.*

A Subscriber at Hull.—*The fault lies with his bookseller or newsman. No additional charge is made for the Supplementary Number to each volume.*

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1349.] SATURDAY, JUNE 16, 1849. [Price 3*d*., Stamped, 4*d*.
Edited by J. C. Robertson, 166, Fleet-street.

MESSRS. LAMB AND SUMMERS'S PATENT IMPROVEMENTS IN STEAM ENGINES, BOILERS, AND AUXILIARY PUMPS.

Fig. 3.

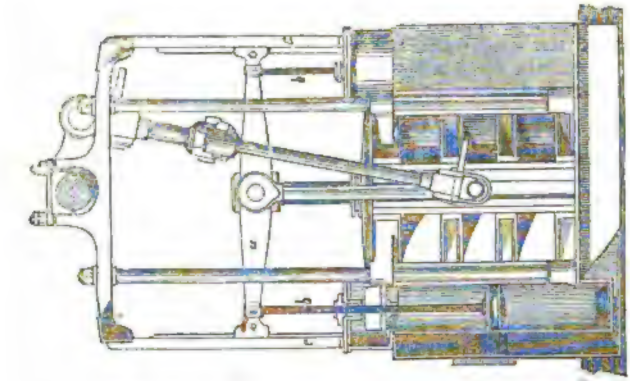


Fig. 2.

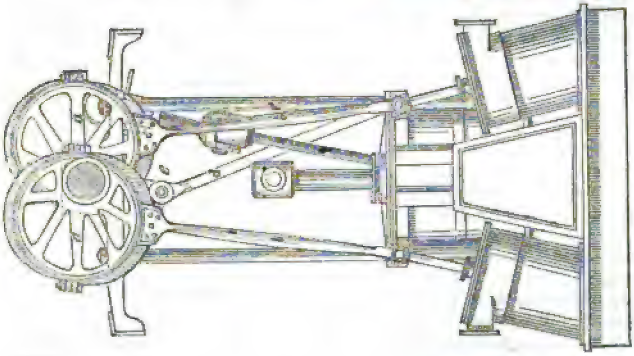
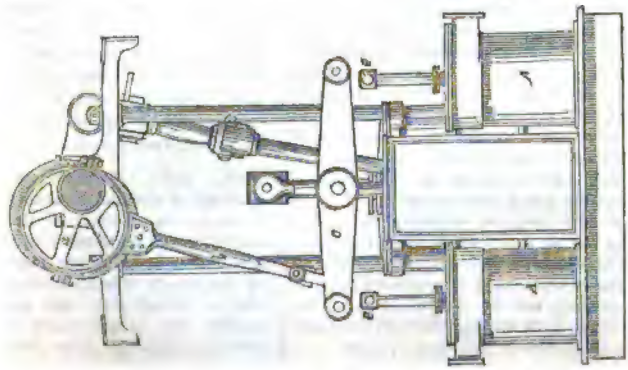


Fig. 1.



MESSRS. LAMB AND SUMMERS'S PATENT IMPROVEMENTS IN STEAM-ENGINES, BOILERS, AND AUXILIARY PUMPS.

[Patent dated December 9, 1848. Specification enrolled June 9, 1849.]

I. *Steam Engines.*—The improvements described by Messrs. Lamb and Summers, under this head, consist of certain improved modes of working the air pump or air pumps. According to one plan, which is exemplified in fig. 1 (a side elevation), as applied to a pair of engines of the double-side-rod engine class, the pumps are worked by means of an eccentric fixed on the intermediate shaft.

A A are the air pumps; *a*, the eccentric which communicates motion by the rod, *b*, to the beam or lever, *c*, which last is connected by the links, *d d*, to the cross-head, *e*, of the pumps.

Another mode of working two air pumps by means of eccentrics is shown in fig. 2.

The air pumps are here placed at an angle to each other, and two eccentrics, *a a*, are connected directly by means of the rods, *b b*, to the air-pump rods, *c c*. The same figure (2) also shows that one eccentric may be used to work two air pumps directly, by attaching two rods to an eccentric strap, as shown in dotted lines at *d*; the rod having a joint at *e*, where it is connected to the eccentric strap.

The patentee adds, on this head, the following remarks:—

Air pumps may also be worked by eccentrics in other positions than those represented in the figures; as, for example, they may be placed immediately under the shaft and worked either by one or by two eccentrics, as may be considered most convenient. The novelty of this part of our invention consists in the employment of eccentrics, in whatever position they may be placed, or however connected to the main shaft. And although we have only shown the eccentric or eccentrics as applied to double side-rod engines, we do not limit our application of them to that particular class of engines, because an eccentric or eccentrics may be used for working the air pump or air pumps of oscillating engines, as well as other engines of the direct acting description.

In double side-rod engines, we prefer working the air pump or air pumps of each engine by attaching their rods, *b b*, directly to the cylinder cross-head, *a*, as shown in fig. 3 (an elevation), and fig. 4 (a plan) . . the air pump buckets moving through the same space as the piston of the steam cylinder . . In double side-rod engines of that description in which the side rods are guided by slides affixed to the sides of the cylinders, the requisite motion for working an air pump may be obtained from studs or pins attached to the lower ends of the side rods. . . Or, instead of the studs or pins being attached to the side rods, they may be connected to the cross-tail side rods.

Claims.—*First.* We claim the employment of eccentrics affixed to or connected with the shafts of steam engines for working the air pump or pumps, as before exemplified and described.

Second. We claim the employment in all such steam engines as have but one piston rod to each cylinder, and the crank connecting rod placed below the crank shaft, of the mode of working the air pumps by attaching their rods directly to the cylinder crosshead, before exemplified and described.

Third. We claim the employment in double-side rod engines, of the description in which the side rods are guided by slides affixed to the sides of the cylinders, of the mode of working the air pumps by means of motion derived from studs or pins attached to the lower ends of the side rods, or to the cross tail side rods, as before exemplified and described.

II. *Steam Boilers.*—The improvements of Messrs. Lamb and Summers have relation solely to tubular boilers, and consist in employing tubes or flues of such form or forms, and so constructed, placed, and arranged, that a larger amount of permanently efficient heating surface can be put into a given space than is practicable with tubes of the ordinary circular form, and readier access can be obtained to all those parts of the boiler which are liable to become choked up with soot, scale, or deposit, in order to the cleansing thereof, as also to the fastenings of the tubes or flues when those are required to be repaired or replaced.

The following is the description of these improvements:—

We make the tubes or flues flat-sided (instead of circular, as usual), and construct them in one or other of the modes represented in the sectional views, fig. 1^a, fig. 2^a, and fig. 3^a. In fig. 1^a, the flues are constructed of two sheets of iron, having each a straight and a curved side, and connected by the curved side of one sheet overlapping the straight side of the other (or *vice versâ*), and being there firmly riveted together. In fig. 2^a, the two sheets are each curved on both sides,

Fig. 5a.

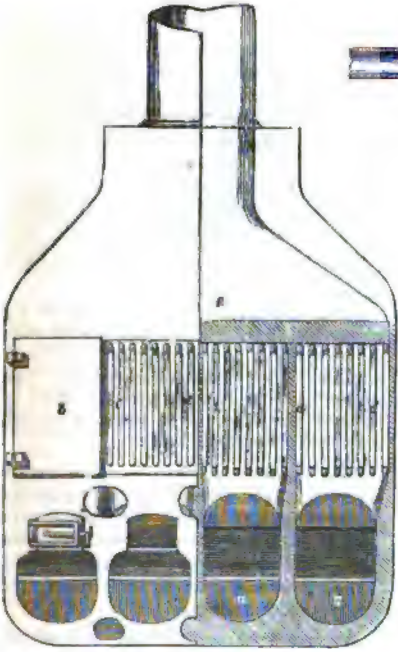


Fig. 4a.

Fig. 6a.

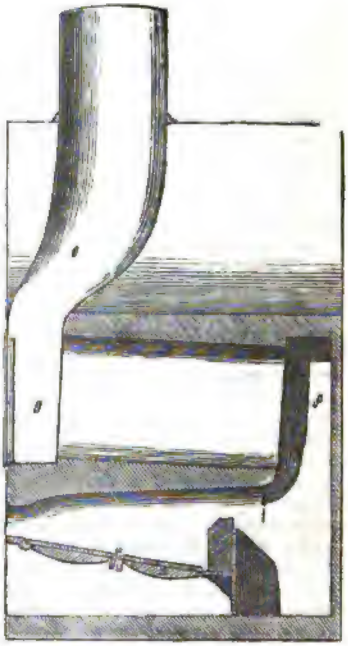


Fig. 3a.

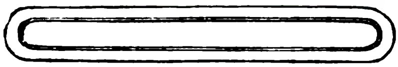


Fig. 2a.

Fig. 1a.

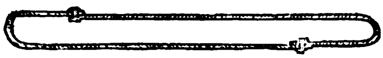
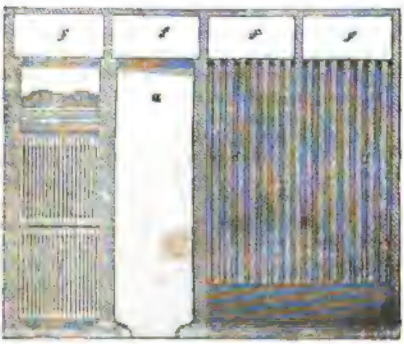


Fig. 7a.



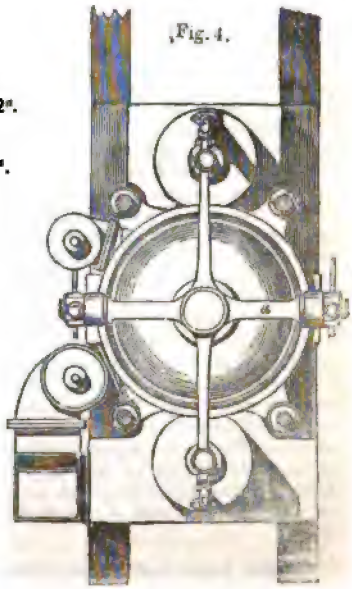


Fig. 4.

and overlap and are riveted together. In fig. 3^a, two sheets are used of the same form as those employed in fig. 1^a; but, instead of being lap-riveted together, they are joined by welding or brazing.

The flues may be stayed in the inside in any of the modes represented in fig. 2^a, and indicated by the letters *k*, *l*, *m*. In the mode *k*, holes are drilled through both sides of each flue, and a thimble or ferrule inserted, and a rivet passed through the thimble and through the sides of the flue. In *l*, the flues are stayed by passing a screwed stay through both sides of the flue, the ends being afterwards burred up against the sides of the flue. In *m*, the flues are riveted by a stud or pin to one side of the flue only, the other or outer end of the stud or pin resting against the opposite side of the flue.

The flues are placed horizontally in the space between the back up-take or chamber at the end of the furnace and the smoke-box which leads into the chimney; spaces of sufficient width (say from two to three inches) being left between them, to allow of an ascending as well as descending current in each water space; and they are secured at both ends to plates common to the whole series of flues by means of angle irons, in the manner shown in fig. 4^a, in which *j* represents one of the plates, and *i i* the angle irons; or by any other suitable means.

Fig. 5^a is partly an end elevation and partly a section of a boiler constructed according to these improvements. The flues, *c c*, are placed above or over the furnaces, *a*, *a*, *a*, *a*; *b* is one of the smoke-box doors, the adjoining one being removed to show the flues, *c c*; *d d* are sections of the flues; *e* is part of the chimney up-take.

Fig. 6^a is a longitudinal section of a boiler through one of the furnaces, showing more clearly the back up-take or chamber *f*, one of the flues *d*, the smoke-box *g*, and the chimney up-take *e*.

Fig. 7^a is a plan of a boiler, with the top and part of the flues removed, in order to show the tops of the flues, the water spaces, the top of one of the furnaces, and the furnace bars, *h*.

Fig. 8^a is partly a section and partly an end elevation of a boiler also constructed according to these improvements, but in which the parts are arranged somewhat differently from the preceding. The flues in this boiler are placed between the furnaces, *a a*. One of the smoke-box doors in the end elevation is removed, in order to show the flues, *c c*, leading to the smoke-box; *d d*, are sections of the flues; *e* is part o the chimney up-take.

Messrs. Lamb and Summers propose further to prevent the great radiation of heat which takes place from the smoke-box doors of steam boilers, and which is productive of so much suffering to engineers and stokers, especially in hot climates, by making the doors with hollow spaces inside of them, through which cold water is kept constantly flowing.

Claims.—Fourth. We claim the combined employment in steam boilers of flues having flat sides, with internal stays, water spaces between them of sufficient width to allow of a descending as well as ascending current in each water space, and smoke-box doors admitting of direct access to the flues, all as before exemplified and described.

Fifth. We claim the construction of the smoke-box doors of steam boilers with water spaces therein, for lowering the temperature of the adjoining engine-room, however these spaces may be supplied with water, or however the water, as it becomes heated, may be discharged therefrom.

III. *Auxiliary Pumps.*—The pumps referred to are those ordinarily used on board of steam vessels for feeding the boilers, and occasionally for washing the decks and pumping out bilge water. The improvement of Messrs. Lamb and Summers consists in

An improved arrangement and adaptation of these pumps, or of certain of the parts thereof, and also an improved mode of giving motion to the same, whether they are worked by steam or manual power. The pump or pumps are worked by an eccentric or eccentrics, or crank or cranks; and both the pump or pumps, and the eccentric or eccentrics, or crank or cranks, as well as part of the eccentric or crank shaft, are enclosed in a box or casing, which serves at the same time as an air vessel for the pumps. Fig. 1^b is a vertical section of a pump constructed on this plan, on a line with the eccentric shaft. Fig. 2^b is a section transverse to the shafts. Fig. 3^b is a plan, with the top of the casing or box removed; and fig. 4^b a section on the line A B in fig. 2^b. *a* is the eccentric shaft; *b b* are the eccentrics; *c c* are rods to connect the eccentrics to the pump buckets, *d*; *e e* are the bottom clacks or valves; *f* is a chamber with an opening, *f*, to which the suction pipe is to be connected; *h* is the aperture of discharge, to which the discharge pipe is to be connectd; *i* is a door, which may be taken off at any time to get at the bottom clacks or valves; *jj* are stuffing boxes, with glands to keep air tight the aperture in the casing or box through which the eccentric shaft passes.

Claim Sixth. We claim the working of the

Fig. 1^b.

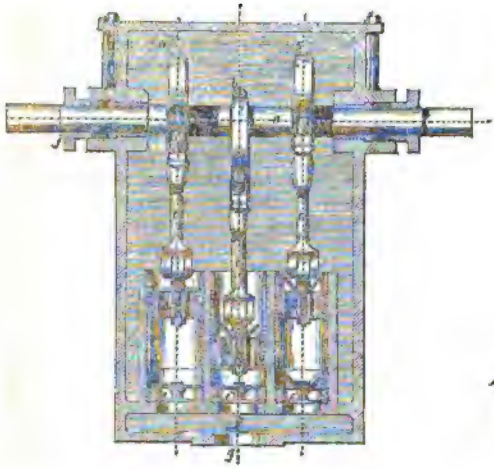


Fig. 2^b.

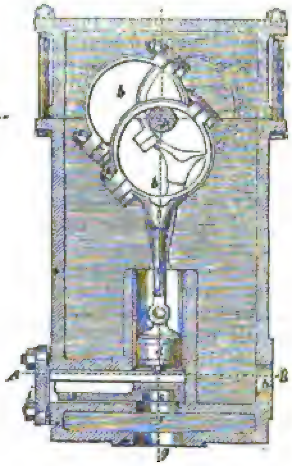


Fig. 3^b.

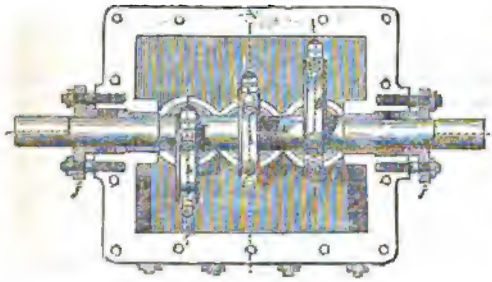
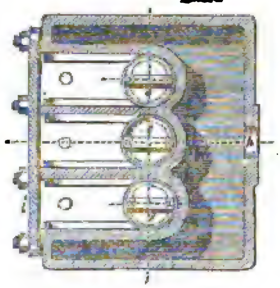


Fig. 4^b.



auxiliary pumps used in steam vessels for filling and feeding the boilers, and other purposes, by means of eccentrics or cranks, and the placing of the pumps and eccentrics, and part of the eccentric or crank shaft within a box or casing, which serves at the same time as the air vessel for the pumps, as before described.

NECESSITY OF A SERIES OF EXPERIMENTS TO ASCERTAIN THE BEST MEANS OF INCREASING THE DURABILITY OF TIMBER.

The particulars on which the durability of timber depends have not yet been ascertained, so that all the seasoning processes that have hitherto been employed may be considered as empirical rather than as grounded on scientific principles. Chemical agents, such as the sulphates of copper, iron, and alumina, the smoke of wood, and pyroligneous acid, have been long generally known to act as preservatives of wood, and corrosive sublimate had been employed about the year 1790 by Dr. George Fordyce for the double purpose of preservation of wood, and for the destruction of insects in it; but whether those preservatives act mechanically, by filling up the pores of wood, to the exclusion of air and moisture—or whether chemically, by the destruction or alteration of fermentable matters remaining in the tree, there are no data to indicate. Sir Samuel Bentham, therefore, at the first institution of the office of Inspector General of Naval Works, in the year 1796, noted amongst the first experiments to be entered on, those which would ascertain this point. It happened, however, a few months afterwards, that a chemist being no longer retained in the

office, the experiments were not made by him, and the General himself attempted to carry them on, but was repeatedly called away from the pursuit of them, nor have any such been made to the present day—yet it is of great importance to ascertain this point.

What is called the water-seasoning of wood appears to be in support of the theory that the duration of timber depends on the destruction, or the getting rid of fermentable matters remaining among the fibres of the wood, those matters being soluble in water. Many facts prove that when timber has been allowed to remain *long* under water, the woody fibre itself is deteriorated; but should it appear that by immersion in water for a *short* time, the prejudicial matters might be washed out, this mode of getting rid of them might be had recourse to without injury to the timber, since as soon as taken out of the water it might be exposed to the dessicating process now coming so generally into use.

The greater durability, as is very generally believed, of winter-felled oak over that felled in spring, seems to indicate that unassimilated juices of the tree tend to corruption of the wood after it is felled; it is known that timber left long to season *in the sap* is very durable, but not equally so when deprived of the sap; but whether those prejudicial juices be decomposed by long seasoning, or by dessication, or whether only dried up, is another point not yet ascertained.

A farther extensive series of experiments which Sir Samuel had in view, and in process of trial, was to ascertain the *comparative* advantages of different chemical agents, taking into account economy no less than efficiency. Experience seemed to indicate that sulphate of iron was as efficacious as either that of copper or alumina, or of corrosive sublimate, and much less costly than these latter agents. It is believed that Dr. G. Fordyce was the first who employed sulphate of iron to prevent dry-rot, and to arrest its progress; he found it perfectly efficacious, using a saturated solution of it in boiling water; but it has for some purposes the disadvantage of giving a yellowish stain to the timber—it was on this account that he used corrosive sublimate in the case where it was desirable to preserve whiteness of the wood.

An exhaustive set of comparative experiments on the means of rendering timber durable, seems well worthy of being undertaken by able chemists.—The builder, and the manufacturer, and the mechanic would be greatly benefited by publication of the results. Calls for reward, now for this process, now for the other, as one or the other might at the moment seem the best, would then cease to drain the public purse—though it may be hoped that the chemist who might make a conclusive series of experiments on the subject would obtain ample remuneration for his trouble by some means. But, alas! the application of science to *general* benefit rarely obtains the pecuniary reward so frequently consequent on private speculation.

Whatever be the process that may eventually prove the most efficacious, it is certain that the impregnation or abstraction should be complete through the whole substance of the timber, as indicated by General Bentham's patent of 24th Jan. 1795. One of the important operations specified in it as being to be performed *in vacuo* was the impregnation of wood with different fluids for its preservation.

Oils have not been adverted to as preservatives of timber, but there seems reason to believe that its impregnation with them would be found useful. Those durable woods, teak and greenheart, contain naturally a considerable quantity of oil; in Sir Samuel's experiments at Plymouth, oil was found to protect timber from the sea-worm. M. A. B.

ON THE TESSARINE ALGEBRA.

Sir,—In endeavouring to establish a Theory of Tessarines, I adhered as closely as possible to the nomenclature and notation of the Quaternion Theory of Sir W. R. Hamilton, and I attempted, by the introduction of a new modular element (the *submodulus*), to keep in view the form of modulus employed in the discussion of Quaternions. There is however, as I have already* intimated to you, a *true* or characteristic Tessarine modulus; in other words, we may express the constituents, w, x, y, z, of a tessarine t in terms of four new quantities M, p, q, r, in such manner that t shall take the form

* *Supra*, page 584.

$$\mathrm{M}f(p, q, r);$$

and further, that the product of the two tessarines

$$\mathrm{M}f(p, q, r) \text{ and } \mathrm{M}'f(p', q', r')$$

shall be of the form

$$\mathrm{M}''f(p'', q'', r'')$$

where $\mathrm{M}''=\mathrm{M}\,\mathrm{M}'$. In this characteristic and peculiar development of the Tessarine Algebra it is easy to show the existence of the modular relation just given. For, by actual multiplication, we find that the expression

$$(\mu^2 \pm 2\nu^2) \times (\mu'^2 \pm 2\nu'^2)$$

is equal to

$$(\mu\mu')^2 + (2\nu\nu')^2 \pm 2\{(\mu\nu')^2 + (\nu\mu')^2\}$$

which, as we know, (*vide sup.*, pp. 106, 294,) is equal to

$$\mu''^2 \pm 2\nu''^2,$$

and indicates the true modular relation $\mathrm{MM}'=\mathrm{M}''$. It remains to determine the form of f, and the values of p'', q'', r'' in terms of p, q, r, p', q', r'; but this I shall not attempt here.

I shall be permitted to suggest a slight extension of a theorem given by me in the *Philosophical Magazine* for the present month (June). Conceive, then, three rectangular axes x, y, z. Let (a, b, c) denote a point on the surface of a right-angled cone whose axis is the axis of y. Let (x, y, z) represent any point in the tangent plane* which passes through (a, b, c); and let u, v, w be respectively equal to

$$bz + cy,\ -az - cx, \text{ and } ay + bx.$$

We shall then have the relation,

$$(a, b, c) \times (x, y, z) = (u, v, w)$$

provided that any point (a', b', c') is represented analytically by

$$i'a' + j'b' + k'c'.$$

The reader who may be desirous of looking further into this part of the subject is referred to p. 105 of the present volume of this Journal. He will then see that, if x and x' are zero, x'' will also vanish, provided that

$$xy' + yx' = 0;$$

and that, if y and y' vanish, y'' will be zero, provided that

$$xz' + zx' = 0;$$

and likewise that, when z and z' vanish, z'' vanishes also, if

$$yz' + zy' = 0.$$

* The equation to this plane is $by - az - cz = 0$.

I have made a further change in the Tessarine notation, and I propose to denote the imaginaries of that theory by i', j', k'; these quantities corresponding respectively to the quantities α, β, γ employed at p. 105 of this volume.

I am, Sir, yours, &c.

JAMES COCKLE.

2, Church-yard Court, Temple,
June 11, 1849.

MR. SIMS'S STEAM WHEEL.*

[From the Annual Report for 1848 of the Royal Cornwall Polytechnic Society.]

Mr. J. Sims, of Redruth, then described a working model of his new steam or hydraulic wheel. In all kinds of mechanism, Mr. Sims remarked, simplicity and portability were desirable objects, as productive of economy in construction, and diminished liability to derangement. He believed that these objects were more fully carried out in the model then exhibited, than had been previously done; he named the invention, a Steam or Hydraulic Wheel—of course, to be worked by steam or water power. As a steam wheel or rotary engine, it appeared to surpass all former attempts of the kind, as in this engine, the motive power was in the piston and cylinder of the ordinary construction of Bolton and Watt's engine; while the expansion principle of cutting off the steam was carried to a greater extent than in those engines, and was accomplished by the motion of the piston being, he would say, independent of the motion of the wheels, and almost instantaneous. In the great variety of rotary or steam wheels that had hitherto come before the public, he was not aware that any of the inventors had availed himself of the benefit of working with the ordinary cylinder and piston, and they had therefore failed to carry out the expansion principle, and also to prevent the leakage of steam, at the extremity of those attempted with vanes,—the disc engine and various others. In some, packing had been attempted; but here the friction was so great and the wear so rapid, that hitherto, not one had succeeded well. In the present model, it would be observed that in the revolution of the wheel, when the cylinder came to a perpendicular position, the steam was admitted underneath the piston at the same time it escaped from the top side, thereby shifting the weight to the top of the wheel, and causing it to revolve by the preponderance of the weight. The power of the engine being the amount of weight moved a certain number of feet in a given time,

* For a ful description, with engravings, of this wheel, see *Mech. Mag.*, vol. xlviii., p. 265.

regularity of motion was essential, and might be accomplished by a good governor. The blow against the buffers was in proportion to the extra quantity of steam admitted, and was on the same principle as the ordinary reciprocating or pumping engine. As an hydraulic engine, this invention was exceedingly well adapted for situations where a good height of water could be obtained, but at the same time not in sufficient quantity for the ordinary kind of water-wheel. The water could be conveyed in pipes, when a very small stream could be made available in proportion to its height and quantity. It would be admitted into the cylinder in the same way as steam was admitted, thereby shifting the weights and making a very effective and economical water-wheel, as every pound of water would be used. The velocity of the wheel would be much superior to that of the ordinary water-wheel, and would be in proportion to the height and consequent pressure and quantity of water obtainable. So also its velocity as a steam wheel would depend on the pressure of steam, admitting the shifting of weights, however quick the passing of the aperture for the admission of the steam. This engine was at present in its infant state; although it worked well, there was no doubt, room for further improvement; and, as its principle was good as regards the application of steam, and water power, and as its economy and portability were very conspicuous, Mr. Sims said it was his intention to continue experiments with it, and he hoped at the next annual meeting of this Society, to be able to report more fully of its advantages, both as a steam and water engine. The application of this engine might be very general, and, he believed, more advantageous than that of almost any other engine, as, in the absence of the crank, each end of the shaft was at liberty for any attachment. This small amount of friction in this engine, consequent on its simplicity, was seen at once, as was also its small amount of liability to derangement.

MR. GARDNER'S PATENT GIRDER.

[Patent dated December 9, 1848; Specification enrolled June 9, 1849.]

Mr. Gardner's patent girder is a striking instance, how a very small matter in the way of invention, may be productive of most important results, and how sound therefore the state policy is, which protects the least amount of ingenuity equally with the highest—the happy thought of a moment, equally with the mature result of years of study and reflection. The novelty in this case consists merely in incorporating into a girder of cast iron, a strengthening bar or bars of wrought iron; but mark the result. A girder made of cast iron alone, and of mass enough to sustain a breaking weight of 43¾ tons would require to be of the weight of 15 tons 17 cwt. 2 qrs.; while one made of cast iron and wrought iron combined in the way proposed by Mr. Gardner, and capable of the same sustaining power (as experiment has proved) need weigh only 10 tons 13 cwt. 2 qrs. 22 lbs. Here therefore we have a saving of 5 tons, 4 cwt. 22lbs.—full one-third of the entire weight. Nor, will the saving be one of quantity and cost alone, for the greater the strength which can be imparted to given weights of metal, the greater will be the distances, which may be safely spanned by the structures in which they are employed.

Mr. Gardner states that by the term girders he means "all beams, bars, or bearings employed in engineering, building, and architectural structures, where materials of great tensile and compressive force are required, as in bridges, viaducts, aqueducts, dock gates, railways, archways, roofings, floorings," &c.

Fig. 1 is an elevation of the central part of a compound girder of this description; fig. 2 is a plan of the same; fig. 3, a transverse section through the middle (A B) of fig. 1; and fig. 4, another section on the line, C D. A is the girder, which is constructed mainly of cast iron, and supposed to be suitable to a span of forty feet in length; B B are the bottom flanges; C C, are two wrought-iron bars, which are introduced into the bottom of the girder at a little distance apart, and are at the centre of each flange slightly bevelled outwards on each side, so as to be in those parts dovetailed, as it were, into the girder. The wrought-iron bars are introduced in the process of casting the girder; and are previously rolled out into the required sectional form, and well cleaned of oxide, by heating them in a furnace or otherwise.

A modification of the preceding plan is shown in the sectional view of a girder given in figure 5, where there is but one bar of wrought iron used, which forms the entire bottom of the girder, and is connected to the upper part by a central ridge of a dovetail form in its cross sec-

Fig. 1.

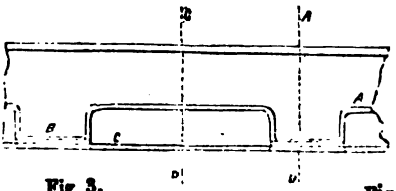


Fig. 2.

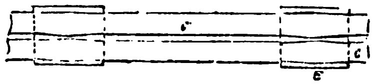


Fig 3.

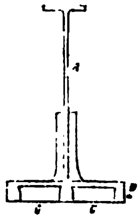


Fig. 4.

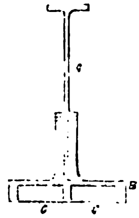


Fig. 5.

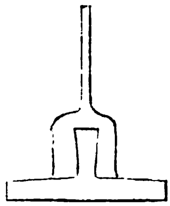
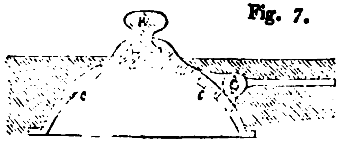


Fig. 6.

Fig. 7.



tion, and of an undulating shape in the longitudinal direction.

Various other modifications in the form of the wrought-iron bars will readily suggest themselves, and may be adapted without prejudice to the principle of the invention.

Figs. 6 and 7 show how this compound mode of construction may be adapted to railway bars and bearings, where these are (as is now ordinarily the case) of great weight. C C, are the cast-iron parts, and W W, the wrought-iron parts.

Claim.—What I claim as of my invention, is the making of girders for bridges and other structures (using the term "girder" in the sense before explained) of cast iron and wrought iron combined together in the manner before described.

MATHEMATICAL PEROIDICALS.

(Continued from page 475.)

XVI. *The British Oracle.*

Origin.—This periodical was commenced about the year 1769, under the title of "The British Oracle; consisting of Questions, Essays, and Dissertations in Natural Philosophy and the Mathematics." The title-page, bearing date 1769, appears to have been issued with the first number of the work, as it forms part of the same numeral paging, and, from the circumstance of the twelfth and last number containing a communication bearing date "March 5th, 1770," it may safely be inferred that the work was discontinued about the middle of that year. It forms a small 8vo volume of 384 pages.

Editor.—No editor's name is appended to the work, nor am I able to offer a probable conjecture on this head, either from internal evidence or otherwise.

Contents.—It has been stated, on very trustworthy authority,† that "*two* volumes of this periodical were published;

viz., one volume of mathematics and one volume of miscellanies, under *two* sets of paging for the two subjects, though parts of each were issued in each number;" but as the latter volume has not yet fallen under my notice, the following description will necessarily be confined to the former.

This portion of the work contains some very curious and valuable mathematical papers, several of them original, and the rest translated from various foreign publications. As some of these are not without historical interest, perhaps the following enumeration may not be unnecessary:—

I. Demonstration of Dr. Pell's famous Geometrical Theorem.

*** This paper includes no fewer than fifteen different geometrical demonstrations of the following

Proposition.

"If one of the acute angles, C, of a right angled triangle, C A D, be bisected by a line, C B, meeting A D in B:—then I say that

$$2\,CA^2 : CA^2 - AB^2 :: AD : AB;$$

or, in the language of trigonometry, *twice the square of the radius is to the excess of the square of the radius above the square of the tangent of the simple arc, as the tangent of the double arc is to the tangent of the simple arc.*"

"This theorem," says the anonymous correspondent, "W. P.," "was first proposed, without demonstration, by Dr. Pell, the author of the *Idea Mathematica*, published in our *Philosophical Transactions*, and made use of by him in his refutation of Longomontanus's *Quadrature of the Circle*, published in 1644." It seems to have attracted much attention amongst mathematicians at the time of its publication, and is frequently mentioned in the correspondence of the principal literary and scientific characters of the day, abundant proof of which may be seen by referring to pp. 76, 81—2, 3, 4—7, 8, 9, and 90 of Halliwell's valuable "*Collection of Letters on the Progress of Science in England.*"

In a letter from Amsterdam, "to his much-esteemed friend, Mr. John Leake, at his house by the Old Swan in Thames Streete, London," Dr. Pell himself declares that his "intent is to appeale the judgments of all those that by demonstrating my fundamental theoreme,

$$\frac{2r^2t}{r^2-t^2}=d,$$

can show themselves able to judge of such a controversy," and so by printing other demonstrations "with my own, and those which I have already of other men's, those ignorant dames may be so much the more confounded to see a thing demonstrated so several ways, which Longomontanus sayd was *indemonstrabile.*" This appeal to the mathematicians of Europe was afterwards made and duly responded to, leading, in fact, to the demonstrations here enumerated; and, from a letter from "Sir William Petty to John Pell," dated Paris, November 8th, 1645," we find that Mr. Hobbes "served him in procuring the demonstrations from the French mathematicians." The question itself would not *now* attract much attention from junior students; for if we put ϕ for the simple arc, the proposition affirms that

$$\tan.\,2\phi = \frac{2r\,\tan.\,\phi}{r^2-\tan^2.\,\phi};$$

or, more simply,

$$\tan.\,2\phi = \frac{2\tan.\,\phi}{1-\tan^2\phi};$$

an obvious property deducible at once from the formula

$$\tan.\,(A+B) = \frac{\tan.\,A+\tan.\,B}{1-\tan.\,A.\,\tan.\,B},$$

by supposing $A=B$. Dr. Pell's letter, and a consultation of the preceding references, will show that the geometers of the 17th century were not disposed to view it thus lightly.

Dem. 1. By M. Roberval, and similarly by Claudius Mydorgius.

Dem. 2. By M. Roberval.

Dem. 3. By Mr. Thomas Hobbes, "the Philosopher of Malmsbury."

Dem. 4. By M. Peter Carcavy.

Dem. 5. By the Hon. Charles Cavendish, who also demonstrated its converse.

Dem. 6. By M. Pallieur.

Dem. 7. By M. F. B. Cavalieri.

Dem. 8. By James Golius, Professor of Mathematics and Arabic at Leyden.

Dem. 9. By John Lewis Wolzogen, an Austrian baron.

Dem. 10. By "W. P.," who communicated the paper to the *Oracle*.

Dem. 11, 12, 13, 14, 15, by the same anonymous correspondent. In these

demonstrations both the analysis and synthesis are given, thus furnishing the student with an instructive example of *variety* in conducting a geometrical investigation. It may be added that these solutions, "a little corrected, were transferred by the late Mr. Michael Fryer, into his edition of Lawson's *Geometrical Analysis*," and they also are made the subject of "honourable mention" by various eminent geometers.

II. A New Theorem in Conic Sections, by "J. B."

III. A Method of Exterminating the Intermediate Terms of a given Equation, by "D. T."

*** This method, if not translated from, is similar to that proposed by Tchirnhausen in the *Acta Eruditorum*, for an account of which reference may be made to Professor Young's *Theory and Solution of Equations*, Art. 81, and to Mr. Cockle's interesting and valuable papers on *Algebraic Equations*, p. 568, vol. xlvi., also p. 540, vol. xlviii., of the *Mechanics' Magazine*.

IV. A theorem of general use in determining the *maxima* and *minima* of the powers of geometrical quantities.

V. A method of finding triangles, which may have their sides, perpendiculars, and the segments of their bases expressed by rational whole numbers. From Schooten's *Exercitationes Mathematica*.

VI. A "Mathematical Recreation," from Ozanam," with a "demonstration by the 'Rev. Mr. B.'"—also, "the same demonstrated by Mr. Stephen Ogle, junior, of Rotherhithe."

VII. On the *maxima* and *minima* of the powers of geometrical quantities, by "M. A. R."

VIII. Upon the game of rencounter, by M. Euler; translated from the *Berlin Memoirs* for the year 1752, by "V. V."

IX. A posthumous paper of M. Cramer; translated from the French by the Rev. John Lawson.

*** This paper contains demonstrations, both by geometry and the principles of fluxions, of the following

Theorem.

"Of all right lined figures that may be described with a given number of given sides, that is the greatest, which can be inscribed in a circle," which is evidently the same as prop. 41, page 104 of *Morton's Geometry*.

X. Geometrical demonstrations, by an eminent foreign mathematician.

*** These propositions are most probably those given by the illustrious Euler in the *Petersburgh Memoirs*, since the paper contains the *generalization* of the property of the trapezium usually ascribed to him. Most of them, however, may be found in some respects more elegantly demonstrated in *Emerson's Geometry*, and the other works to which reference is made.

Prop. 1 is an elegant geometrical proposition, originally proposed by Mr. Ferrant to Dr. Wallis; it forms ques. 606 in the *Ladies' Diary* for 1770, and appears to have been first demonstrated *geometrically* in that work by *Clericus*, probably Lawson. The case of the intercepted segment being a *maximum*, is given as ques. 620 of the same periodical, proposed by Captain Williams, and answered by the Revs. Crakelt and Wildbore. The proposition is also given in *Bland's Geom. Problems*, sect. 6, prop. 62; and *Leslie's Geometry*, 4th Ed., p. 362.

Prop. 2, Theorem I. *Emerson's Geometry*, prop. 30, book iv.

Prop. 3, Theorem II. *Emerson's Geometry*, *ibid.*

Prop. 4, Theorem III. *Davies's Horæ Geom.*, prop. vii., cor. 3.

Prop. 5, Theorem IV. *Emerson's Geom.*, prop. 38, B. ii.

Prop. 6, Theorem I., p. 228. *Emerson's Geom.* Prop. 40, B. iv.

Prop. 9, Theorem IV., p. 233. *Emerson's Geom*, *ibid.*; also *Leslie's Geom.*, pp. 368-9, 4th edition.

Prop. 10. Theorem p. 263.—This proposition contains the generalization previously alluded to, and is the same as prop. 13, b. iii., *Emerson's Geometry*. Elegant demonstrations of the same property are also given in *Leslie's Geometry*, prop. iv., p. 318; and *Bland's Geom. Prob.*, prop. 37, sect. 4.

XI. The solution of a very difficult question, viz., "To find a right-angled triangle in rational numbers, so that each of its legs, when diminished by the area of the triangle, may give a square number;" it was proposed by M. Ferrant, and communicated by Mr. "W. V."

*** A similar question may be seen in *Ozanam's Algebra*, and it also forms ques. 638 of the *Ladies' Diary*, proposed by Mr. Wildbore, and answered by himself and Mr. Crakelt. Mr. Wildbore afterwards completed the process in ques. 51 of *Hutton's Miscellanea Mathematica.*

XII. A Synopsis of Data for Right-angled Triangles, by the Rev. John Lawson.

*** This paper contains a collection of 47 data for the construction of triangles, of which 21 had been constructed *generally* without reference to the species of the triangle:—it formed the *germ* of the work so well known to geometers by the name of *Lawson's Synopsis.*

XIII. A construction and demonstration of the following problem from *Ozanam's Recreations;* viz., "Upon the circumference of a given circle to find an arc, the sine of which may be equal to the chord of the complement of that arc;" by Mr. W. Vivar.

XIV. On the "Ratio of the Equilateral Cone and Cylinder circumscribing the same Sphere;" by Mr. T. Morris. See *Emerson's Geometry*, prop. 11, b. vii.

XV. On the method of finding the product of any two digits, by means of the fingers of the hand; communicated by Mr. D. Bolton.

XVI. Two mechanical theorems; by Mr. "H."

XVII. A translation of "*Pascal's* Treatise on the Arithmetical Triangle;" by "I. L." (Probably the Rev. John Lawson.)

XVIII. On the reduction of curve lines to circular arcs; translated from the Latin of Euler, by Mr. T. Morris.

Questions. — The total number of questions proposed in this periodical was 127, of which 107 were answered: the remaining questions consist of *two* sets of ten each, which were intended to be solved in Nos. 1 and 2 of the second volume. The first 72 of the "questions which had been proposed in the *Ladies' Diary*" were also reprinted in this work, and since most of the solutions to these are given anonymously, they were most probably furnished by the editor of the *Oracle.* Of the *original* questions, 26 belong to pure algebra, 30 to geometrical analysis and construction 12 to algebra and its applications, 7 to plane and spherical trigonometry, 13 to mechanics, and 19 to fluxions. Many of these are of peculiar elegance and importance, furnishing a series of exercises well calculated to store the mind and improve the taste of the inquiring student. With respect to the *geometrical* portion, no word of commendation will be needed when it is known that it contains some of the best specimens of such geometers as Lawson, Crakelt, Ogle, Coughron, and Parker.

Ques. 6 is proposed by the Rev. Mr. L., of Cambridge, and requires the method of drawing two right lines from two given points, to terminate in a line given in position, so that their included angle may be a maximum: a question which has been considered in *Simpson's Algebra*, prob. 44; *Select Exercises*, prob. 48; and also in the *Leed's Correspondent*, vol. i., ques. 18.

Ques. 9 is proposed by Mr. Reuben Burrow, afterwards editor of *Carnan's Diary*, and requires "to divide a given ellipse into any given number of ellipses, which may be to each other in a given ratio."

Quests. 14 and 48, give the "sum, sum of the squares, sum of the cubes, &c., of any number of quantities, to find those quantities;" a class of equations for which a general method of solution is given by Mr. George Coughron in *Hutton's Misc. Mathem.*, art. 19.

Ques. 32 is proposed by Mr. Ogle, and inscribes a square in a given *heptagon:* — the inscription of the greatest rectangle in a given *pentagon*, forms the subject of the 42nd question, proposed by Mr. Dawson.

Ques. 54 relates to the direction of the *minimum* power that will sustain a given weight on a given inclined plane, a question which appears to have been incorrectly solved by "one *Curious* in the *Town and Country Magazine.*"

Ques. 59 was proposed by Master John Spencer, and demonstrates the formula,

$$\tan.^2\frac{A}{2}=\frac{\text{vers. }A}{1+\cos.\,A};$$

which is evidently equivalent to

$$\tan.^2\frac{A}{2}=\frac{1-\cos.\,A}{1+\cos.\,A}.$$

(*Rutherford's Hutton*, p. 578.)

Ques. 67 is a prize question proposed by Mr. Ogle, and gives "the base and vertical angle of a triangle to find the *locus* of its inscribed circle;"—the silver medal was awarded to the Rev. John Lawson for his elegant geometrical solution. For other investigations of the same locus, reference may be made to *Young's Anal. Geom.*, vol. i., p. 77; and *Davies's Solutions*, p. 496.

Ques. 73 is proposed by Mr. T. Vessey, and gives the following neat property of the *common tangents* to two circles:—Let AI and BK be the radii, DE the *exterior* tangent, GH the *interior*; then universally 4 AI. BK = $DE^2 - GH^2$.

Ques. 75 gives the length and superfices of a rectangular piece of timber, to find the breadth and depth, so that its strength may be a maximum; it was proposed by Mr. Samuel (afterwards Professor) Vince.

Ques. 76 relates to the "curve of quickest descent;" and ques. 77 investigates "the force wherewith a given corpuscular line is attracted by a given magnetical line, meeting the former perpendicularly at its extremity; supposing the law of attraction to be in the reciprocal duplicate ratio of the distance."

Ques. 87 is the 34th of *Lawson's Synopsis* previously mentioned, of which he says, "he never saw but one construction of it, and that in a Latin author little read." Probably the work alluded to is *De Billy's Nova Geometricæ*, respecting which the following curious note occurs in *Maynard's Catalogue*, No. ix., p. 14, "De Billy was one of the most successful cultivators of the Diophantine analysis, and Dr. Lawson in his *Synopsis* of the Data of Triangles (1773) has enumerated between 70 and 80 cases of right-angled triangles, which he says have not been constructed in general, which may all be found in this work. Mr. Ogle obtained the prize medal for his solution of this question.

Ques. 89 requires "to cut an elliptical cone in such a manner that the section may be circular;" it was first "proposed in the *Gentleman's Magazine* for May, 1768;" but the solution there given being defective, led to its re-proposal in the *Oracle*.

Ques. 91 gives the common base and the vertical angles of two triangles, to determine them by construction, when their perpendiculars are in the ratio of 2 : 1; this question is obviously formed from prob. 65 of the *Mathematician*, and was elegantly solved by Mr. Thomas Barker.

Ques. 103 relates to the emptying of a spheriodal vessel through a circular orifice at the bottom; a subject which was afterwards very amply and ably discussed by Dr. Hutton in the first number of his *Misc. Mathematica*. This "Dissertation" has since been reprinted by Professor Leybourn in the fourth volume of his edition of the *Ladies' Diary*.

Contributors.—Messrs. Adams, Allen, Barber, Barker, Bayley, Bolton, Bonner, Burrow, Butler, Coughron, Cragg, Crakelt, Crocker, Dawson, Duffers, Gawith, Gemini, Hardy, Johnson, Judson, Langley, Lawson, Lowe, M'Carty, Morris, Moss, Ogle, Paddon, Reynolds, Sewell, Shircliffe, Slee, Smith, Tarrat, Todd, Vessey, Vince, Vivar, Ward, Wilkin, &c.

Publication.— Supposing the conjecture offered under the first head of this paper to be correct, the publication would appear to be *monthly*, but of this there is no satisfactory proof in the volume consulted. The twelve numbers published were bound as one volume, which was "printed for W. Oxlade, behind the Chapter House, the north side of St. Paul's Churchyard, London, 1769."

THOMAS WILKINSON.

Burnley, Lancashire, June 11, 1849.

ANIMAL ELECTRICITY.

Considerable attention has been called, particularly in France, to some experiments of M. du Bois Reymond which appear to show that the needle of a delicate galvanometer may be deflected by some effect of muscular energy. As the results involve many important considerations, it will be the most correct course to describe exactly the original experiment. Two plates of platina of the same size are connected with a delicate galvanometer. Two glasses are filled with a solution of salt and water. Everything being so arranged that no external agitation can disturb the needles—the two platina plates are placed, one in each glass—the muscles of one arm are now

excited in such a manner as to develope their full power, and then the index-finger of each hand is plunged into the fluid in the glasses. "With my galvanometer," says M. du Bois Reymond, "the deviation of the galvanometric needle amounts to 30°. I obtain however much more extensive movements of the needle, by contracting alternately the muscles of one and then of the other arm." M. de Humboldt states in his letter of the 17th of May to M. Arago, that notwithstanding his great age the deviations of the needle when he has tried the experiment have been very great. I have carefully repeated the experiments of M. du Bois Reymond; but I have succeeded in obtaining a good result only when I have firmly grasped one of the plates of platina, and brought the index-finger gently in contact with the other. In this way the needles of a galvanometer which is not remarkably delicate were deflected at different times from 20° to 30°. There are some points in connection with these experiments to which I am anxious to call attention. M. Despretz and M. Becquerel made on the 28th of May communications to the *Académie des Sciences de Paris* on the above subject, and they appear disposed to refer the effect produced to some of the disturbing agents chemical or thermic, with which we are acquainted. A few careful experiments appear however to prove, that although both heat and chemical action may produce results which tend to complicate the phenomenon, they can be eliminated —their errors avoided or allowed for and the fundamental fact brought out with clearness. The following were the experiments which were tried,—the galvanometer and the wires connected with the platina plates, which were 8 inches long and 1½ inch wide being secured firmly to a table—

1. Two glasses, containing salt and water in the proportion of four ounces to an imperial pint, were prepared, and the platina plates placed to the depth of 2 inches in the fluid. The muscles of the right arm being powerfully contracted, the index-finger of each hand was plunged into the saline solutions. A tremor was produced upon the needle; but on no occasion could I succeed in obtaining a deviation of more than 2°. Several friends, one of them a gentleman of great muscular energy, tried the experiment, but they did not succeed in producing a greater deflection.

2. A basin was substituted for one of the glasses, and the whole hand was plunged into the liquid, but there was no greater deflection. It is evident from this that the extent of animal surface which is placed in the fluid does not alter the result. But upon grasping the platina plate and holding it firmly, pressing it with the fingers against the palm of the hand, the needle was immediately deflected 12°; and upon loosening and resuming the grasp, as the needle returned to its zero point, the deflections arose to 25°. After this they gradually lessened, until, notwithstanding the greatest exertion, they did not pass 8°. As all the conditions remained the same, this reduction in the current can be referred only to a loss of power in the muscles.

3. Thinking it probable that the mechanical exertion developing an increased amount of heat might have given rise to thermo-electric currents, I substituted a hot solution on one side of the arrangement, still keeping the other cold. The connection was made by the fingers between the two, but with no increased action on the galvanometer; and even when a piece of wet cotton was placed across the basin and glass, from the hot to the cold fluid, the permanent deflection was only 2°. When the hand was plunged in the basin containing the hot solution, and the platina grasped firmly, the deflections varied from 12° to 25°. When the hot water was in the glass, and cold in the basin, and the contractions energetically made, I however succeeded in obtaining a deflection of 33°. These results prove that the result is not due to any thermo-electric action.

4. With the view of ascertaining if chemical action produced upon the surface of the plates had anything to do with the development of electricity in the circuit, plates of zinc and of copper were substituted for platina. After the first deflection of the galvanometer, arising from the surface action at the moment of immersion in the brine had subsided and the needle returned to its zero, the experiment was repeated as before, and in every case the deflections produced by muscular contraction were less than those exhibited when platina plates were employed.

As I have already remarked, many sources of error present themselves in experiments of so delicate a nature as the above; but it does appear that we have indications of electrical disturbances which are not due to ordinary thermic or chemical action, and which depend upon the mechanical force employed in the muscular power exerted. M. Desprets says "the necessity for multiplying experiments is evident; since we find the results of two or three experiments confirming those of M. du Bois Reymond—and again two or three contradicting them." The necessity for carefully repeating the examination is imperative; but as far as my brief investigation has gone, I am disposed to consider the opposing results observed by

M. Desprets as due to the exhaustion of muscular force after the first experiments have been made—as, repeatedly the deflections from 20° have fallen back slowly to 5° and sometimes, notwithstanding violent efforts, even to zero—whereas, after the arm has been rested for a few hours the original deflection has been again established. The question bears too importantly upon the entire phenomena of animal electricity to be hastily dismissed,—and it will without doubt receive a searching examination.

ROBERT HUNT.

—*Athenæum.*

ON FLAMBING THE BOWS OF SHIPS.

Sir,—The too-prevalent idea that flambing bows above water tends to reduce the amount of pitching, and that a fulness under water tends to prevent it, are untenable, the reverse effects being the consequences of these forms, as will appear from the following:—

Let us suppose two vessels of equal total displacement, to be represented by A and B (see next page), and their respective transverse vertical sections below the water line at *a* and *b* in the figures, equidistant from their stems to be represented by fig. *a* and *b*. Suppose, also, these vessels moved with equal velocity against a head-sea, and that their stems have arrived as far as the crest of the wave. The vessels are represented as in the horizontal position, but it is obvious they cannot remain thus, and it is also obvious that their motions will be unequal, for—

1st, Because the displacement, or weight of the section of A before *a*, is very much greater than the similar one before *b* in B, its momentum will be greater. 2nd., As the area of section *a* is greater than that of *b*, the quantity of water which will strike upon *a* will be greater, and consequently the momentum of that water will be greater; but as the shocks which a vessel has to sustain from a head-sea, are made up of, or are equal to, the joint momenta of the water and of the ship, so those which A will receive will be vastly greater than those which B will receive.

Again; it is obvious, that as the displacement of A before *a* is greater, so so also must the rise of A over that of B be greater.

Suppose now, these vessels moved on till their sterns arrive at the centre of the hollow between the waves, and the results will be these—

Because the displacement of A before before *a* is greater than that before *b* in B, so A will lose more buoyancy by the passage of the wave aft than B, and *a* will consequently require to fall further than B before the equilibrium of weight and buoyancy are restored; but as the weight of *a* is greater, so also will be its momentum in falling into the hollow of the sea; from which circumstances, that is, the greater rise of *a* in passing a wave, and the greater fall after having passed it, together with the greater shocks occasioned by the form of *a* over those resulting from the form of *b*, the velocity of A though equal to that of B at first, from their having equal motive power, cannot be sustained, while the shocks which A receives being greater, they will be more injurious to the strength of the fabric than those received by B.

The pitching motion which obtains from the causes described above is sought to be remedied by giving vessels above the water line a form such as *g*, as contra-distinguished to the form of *f*.

But this only increases the evil, as the greater weight and buoyancy of *g* over those of *f* will produce similarly injurious effects as those described as resulting from the greater weight and buoyancy of *a* over those of *b*; yet granting the idea that the form of *g*, above water, is such as to catch the vessel when descending and to prevent her falling, to be so far correct, this form cannot be obtained without an increase of weight; the form therefore could only lessen *the evil its greater* weight *had first increased.*

The larger the proportion of the displacement which is emerged by the passage of a sea aft from the bow, as compared with the total displacement of any vessel, the greater will be the amount of motion produced by its passage. It is owing to this that a greater amount of motion is produced in a short ship, and that she makes less way against a head-sea than a longer one.

Nor is the weight the only moving force causing the shorter vessel to pitch deeper; for, in emerging her bow by a greater quantity than the longer one, she loses a considerably greater amount of longitudinal stability; consequently the power of the wind, which is equal, and situate equally high, (the area and height of sail

being the same in each) will cause the shorter to revolve a greater quantity; that is, she will be more pressed down forward than the longer vessel.

But granting that greater fulness of the foremast sections of the bow were not proved to be objectionable, its effects on the after body must not be overlooked.

Fig. a.

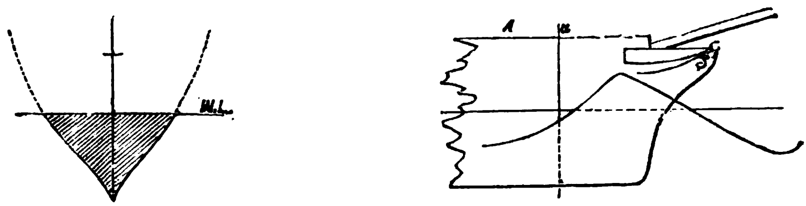


Fig. b.

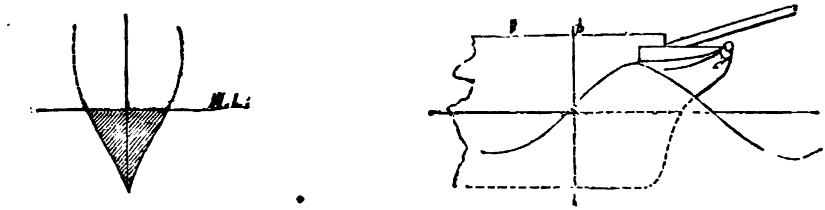


Fig. g.

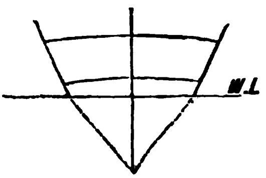
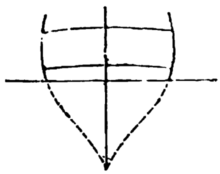


Fig. f.



Let it be assumed, that the buoyancy added to the bow of a vessel, by giving her a form such as *g*, is ten tons (above the water line), the effect of this on her when running before a sea would be the same as if ten tons of buoyancy were taken from abaft, on the supposition that the centre of gravity is in the middle of the water line; that is, the stern would be prevented from rising to the sea by a power equal to ten tons applied at the extremity, greater than the weight of any pivot gun and its carriage, &c.

F.——

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING 15TH OF JUNE.

James Young, of Manchester, manufacturing chemist. *For improvements in the preparation of certain materials, used in dyeing and printing.* Patent dated December 9, 1848.

The "materials" referred to, are "the stannate and stannite of soda, the stannate and stannite of potash, the bichloride of tin, and other analogous preparations of tin;" and Mr. Young's improvements in relation thereto, consist in the following "improved modes or processes of preparing or manufacturing them on a large scale."

Firstly. To make stannate of soda, I put

a quantity of tin ore, or what is commonly known in Cornwall by the name of "black tin," reduced to powder, into an iron pot, along with a solution of caustic soda, and set the pot on a fire to boil. The proportions in which I use these ingredients vary with their respective qualities. If the ore contain (say) 70 per cent. of tin, I use about two and a half times its weight of caustic soda liquor, containing about 22 per cent. of soda, increasing or diminishing the proportion of the liquor employed according as it is desired to produce a stannate with a greater or less excess of alkali. I keep the materials well stirred, and gradually raise the heat up to between 500° and 600° Fahr., at which temperature the ore is acted upon by the soda, and the tin, or oxide of tin contained therein, or the greater part thereof, combines with the soda. The progress of the operation may be known from time to time by taking out of the pot a small portion of the mass, and ascertaining how much of it dissolves in water, and how much of the ore has been left unacted upon. The hot mass is then transferred from the pot to another vessel, and set to cool. And when cooled, it is mixed with water, when any insoluble matters which may have remained in it, unaffected by the caustic soda, are easily separated by filtration or by subsidence. The clear liquor which remains is the stannate required, which may be either employed in that state or evaporated to dryness, or crystallized, the solid salt being dissolved as required for use.

Secondly. I also prepare stannate of soda by mixing a quantity of tin ore reduced to powder with one and a half times its weight of nitrate of soda, subjecting the mixture to a red heat in an iron vessel, passing a current of steam over it, and keeping it constantly stirred during the operation, in order to expose fresh portions of it to the action of the steam. Nitric and nitrous acids are given off in fumes which may be condensed with water, and collected as collateral products (reducing thereby the cost of the stannate). Stannate remains which may be freed from its insoluble impurities by mixing it with water, and filtration or subsidence, as in the process first before described; and it may be also left either in a state of solution, or crystallised, or evaporated, as aforesaid.

Thirdly. I substitute for the nitrate of soda employed in the last preceding process chloride of sodium (common salt), using, however, equal weights of the salt and tin ore; and pursuing the same process in all other respects, I also obtain thereby stannate of soda, with muriatic acid as the collateral product.

Fourthly. I obtain by the following process both stannite of soda and stannate of soda. I subject to a red heat a quantity of metallic tin mixed with an equal weight of solid hydrate of caustic soda, (which may be obtained by boiling down caustic soda liquor, say 3½ cwt. of the liquor containing 22 per cent. of soda to about 1 cwt. of the hydrate), stirring the materials well during the operation; whereupon the water of the hydrate of soda becomes decomposed, and parts with its oxygen to the tin, and the oxide of tin so formed, uniting with the soda, forms a stannite of soda, suitable for some dyeing and printing purposes. To convert this stannite of soda into a stannate of soda, I boil it in water, on which a portion of metallic tin is precipitated in the form of a black powder, and the solution remaining is stannate of soda. Or, I take twenty parts of metallic tin, sixteen parts of solid hydrate of caustic soda, and three parts of oxide of manganese (all by weight) and subject them to a red heat in an open pot, keeping the mixture constantly agitated, and allowing a free access of air. So small a portion of oxide of manganese as is contained in this mixture would be quite insufficient of itself to peroxidize all the tin, but this oxide of manganese is converted by the heat, and absorption of oxygen from the atmosphere, into a manganate of soda, and this manganate becomes decomposed by the tin, on which part goes to form peroxide of tin, leaving a residuum of oxide of manganese, which becomes once more, by a new absorption of atmospheric oxygen, a manganate, and that manganate is decomposed by the tin as before, yielding a fresh accession of peroxide of tin; and so the process goes on until all, or nearly all, the tin has become peroxidized and combined with the soda. The mass in the pot is then dissolved in water, and the solution clarified by filtration or subsidence. The supernatent liquid is a solution of stannate of soda, which may be either left as it is, or crystallized, or evaporated to dryness, as aforesaid. The precipitated oxide of manganese may be collected and used over again.

The stannite formed in the first of the processes described under this branch of my specification may be formed into stannate of soda by merely keeping it freely exposed, at a red heat, to the atmosphere for a sufficient length of time; but I prefer the oxidizing process by means of manganese, as more expeditious, and, on the whole, cheaper.

Fifthly. I also employ for the formation of stannate of soda oxide of tin, which I obtain by heating metallic tin to redness in an iron vessel, keeping it well stirred, and passing a current of steam or air over it.

And this oxide of tin I treat, along with caustic soda, in precisely the same way as the ore has been before directed to be treated.

Sixthly. I manufacture stannate of potash by each and every of the methods before described of manufacturing stannate of soda, substituting only in each case where caustic soda, or nitrate of soda, or chloride of sodium is directed to be employed, an equivalent of caustic potash, or of nitrate of potash, or of the chloride of potassium, as the case may be.

Seventhly. I also manufacture stannite of potash by the same process as stannite of soda is before directed to be produced, substituting for the hydrate of soda an equivalent of hydrate of potash.

Eighthly. I manufacture stannate of lime, or a stannate of any of the other alkaline earths, by substituting a hydrate, or nitrate, or muriate of the said lime or other alkaline earth for the soda or potash, or for the nitrates or muriates of soda and potash, directed to be used in the processes before described; and from any of these stannates I procure peroxide of tin, soluble in acids, by adding an acid, such as muriatic, which combines with the lime or other alkaline earth, setting free the preoxide of tin, and forming a soluble salt with the earth, which may be separated from the peroxide of tin by washing with water.

Ninthly. I manufacture peroxide of tin (otherwise binoxide of tin or stannic acid) by passing carbonic acid into a solution of stannate of soda or stannate of potash, or by passing carbonic acid over either of these salts, in a dry or damp state, until all, or nearly all, the alkali is converted into carbonate, separating the peroxide of tin which is set free by washing with water, and filtering or decanting off the solution of carbonate of soda or potash. Or I add sulphuric or any other convenient acid to a solution of the stannate, which precipitates the oxide of tin, after which the solution of the salt of the alkali is easily separated by filtration or decantation. Or, lastly, bicarbonate of soda, or potash, or bisulphate of soda and potash may be mixed with the stannate solution, which will convert the alkali of the stannate into carbonate and precipitate the peroxide of tin; which may be separated as in the preceding case by filtering or decantation.

Tenthly. I manufacture any of the salts of peroxide of tin, by treating the peroxide (obtained from the stannates of soda or potash, or from the stannates of lime, or other alkaline earth, by any of the processes before described,) with the acid necessary to produce the particular salt required. If, for example, oxymuriate of tin (otherwise bichloride of tin) is required to be produced, I add peroxide of tin to muriatic acid until the last portion added remains undissolved. The clear liquor is the oxymuriate in a state ready for use.

For the tin ore and metallic tin used in some of the preceding processes, the refuse of the tin smelting works, called tin slag, may be occasionally substituted with advantage. It is to be reduced like the ore to a state of powder, and used either with soda or potash, or with the muriate of soda or potash, or with the nitrate of soda or potash, or with soda or potash, and oxide of manganese; excepting only as regards the last, when the tin contained in the slag is in the state of peroxide of tin, in which case the oxide of manganese will not be required.

Claims.—First. I claim the preparation of stannate of soda and stannate of potash by the process first before described, in so far as regards the heating of the tin ore reduced to powder along with the caustic soda or potash.

Second. I claim the preparation of stannate of soda and stannate of potash by the processes secondly and thirdly before described, in so far as regards the heating of tin ore, reduced to powder, along with nitrate of soda or nitrate of potash, muriate of soda, or muriate of potash, and passing currents of steam over the same.

Third. I claim the obtaining of stannate of soda and stannate of potash from metallic tin, combined with a hydrate of caustic soda or potash, or with a hydrate of caustic soda, or potash, and manganese, by the modes or processes described under the fourth head of this specification.

Fourth. I claim the obtaining of stannite of soda and stannite of potash by the first part of the modes or processes described under the said fourth head of this specification.

Fifth. I claim the obtaining of stannate of soda or potash from metallic tin, which has been oxidised in the manner described, and afterwards treated as before directed.

Sixth. I claim the preparation of the stannate of lime, and other stannates of alkaline earths, in manner before directed.

Seventh. I claim the preparation of peroxide of tin by each and every of the methods or processes before described.

Eighth. I claim the preparation of oxymuriate of tin and other salts of peroxide of tin by treatment of the peroxide of tin (obtained in the way described) with acids as before described.

Ninth. I claim the employment of tin slag, whenever it can be used, as a substitute

for tin ore or metallic tin in any of the processes described.

And, in conclusion, I declare that I make no claim to the conversion of any of the solutions aforesaid into crystals, or dry salt, by evaporation, which is a common chemical process, but that I claim exclusive right to the stannates and stannites prepared by the improved processes herein described and claimed, whether such stannates and stannites are evaporated to dryness or crystallised, or not evaporated to dryness or crystallised before use.

William Ironside Tait, of Rugby, printer and bookseller. *For an improved method or methods of producing outlines on paper, pasteboard, parchment, papier-mâché, and other like fabrics.* Patent dated December 9, 1848.

Firstly. My invention has for its object to facilitate the acquirement of a knowledge of geography, by providing for the use of students blank sheets of paper (or of any other of the materials aforesaid), each punctured with such guide marks for the delineation of some portion or other of the globe, that the student shall have but to connect these marks by suitable lines, straight or curved, in order to produce a complete outline map of the same. The manner in which I accomplish this is as follows:—I paste a copy of a map of the portion of the globe intended to be outlined upon a well-planished and thin plate of some soft metal, as zinc or pewter, and when it has become quite dry, I prick the map through with a dry style at every point where I think it advisable to leave a mark for the guidance of the sketcher, and with such force as to raise a burr on the outside surface of the metal plate beneath. For example, I mark by a single puncture each point where the lines of latitude and longitude intersect each other, and also the point where each of these lines terminates, so that when these punctures are transferred to the sheet of paper, it is only necessary to connect point to point to produce the divisional lines in full. And when coast or river lines are to be indicated, I make the guide punctures more or less numerous, that is to say, at a greater or less distance apart, according as the lines are more or less waving or tortuous. Again; mountains, lakes, cities, towns, and other prominent objects, I denote by punctures larger than the others, or by clusters of punctures in the form of circles, triangles, crosses, &c. From the plate which has been thus punctured, that is to say, from the burred side of it (which is the opposite of that to which the original map was pasted), I afterwards take as many impressions as I want on plain paper (or any of the other fabrics aforesaid), by means of a copper-plate or any other suitable press; and when the burrs become worn down from use, I restore them to their original sharpness by repuncturing them with the style from the opposite side.

Secondly. My invention consists in producing outline maps of the same description as the preceding, but with the impressions of the punctures in visible colours, as black, blue, or red. I effect this by placing a sheet of paper or cloth, coated or saturated with the desired colour (similar to the carbonic sheets used in letter-copying machines) between the punctured plate, while it is in the course of being printed from, and the paper (or other material) which receives the impression.

Thirdly. My invention consists in directly puncturing plates of metal, that is to say, without the superposition of any copy, as in the preceding cases, with dotted outlines of objects of all sorts, and taking impressions from the same, either colourless or in colours, by the processes before described.

Fourthly. My invention consists in the construction of a cylinder press suitable for taking impressions of dotted outlines from plates punctured by either of the processes before described.

[A description of this press follows, which it is unnecessary to give, as the patentee does not confine himself to the use of it alone.]

Fifthly. My invention consists in engraving continuous outlines of maps and other subjects upon plates of metal in the usual way, and taking dry impressions thereof, or impressions without ink or colour on paper or any other of the fabrics aforesaid, by pressure of the plates on the paper, or of the paper on the plates, effected by means of a letter-press, or any other suitable machine.

Sixthly. My invention consists in taking casts in gutta percha of the outline plates, both dotted and continuous, produced by the processes before described, and printing from such casts in the same way as from the original plates themselves. The gutta percha may be either poured in a state of solution over the plates (enclosing them for the time in a temporary rim or chasing), and allowed to cool, or used in the state of solid slabs, warmed to a sufficient degree of plasticity to be readily indented by pressing them upon the plates or the plates upon them.

Seventhly. In order to the production on paper and the other fabrics aforesaid, of coloured straight lines, or of divergent and convergent lines, like the lines of longitude and latitude laid down according to Mercator's projection, or of waving lines, I make use of an apparatus of the description represented in fig. 2.

[Of this apparatus a brief description may suffice. The paper to be ruled is laid on an endless web, with a sheet of cloth or paper beneath charged with colour, and the web revolves under a crosshead of India-rubber, in which are inserted a series of dull-pointed needles, which, by pressure, produce the required lines. Divergency or convergency is produced by a second endless web placed above the other, which carries a tablet of gutta percha, in which grooves are cut corresponding to the lines desired to be produced, which grooves catch the heads of the needles as this second web revolves, and impart to them the requisite angles of inclination.]

Eightly. To facilitate the drawing, in outline maps, of the lines of longitude and latitude, I cut thin plates of metal, sheets of card-board or other suitable substance, through and through, in lines corresponding to the said lines of longitude and latitude, and thus form guide frames by the superposition of which on the paper or other fabric, the required lines can be readily filled in with pen or pencil.

Ninthly. I produce raised outlines on paper, or any other of the fabrics aforesaid, for the use of blind persons, of letters, numerals, and other characters, by first striking out the same in metal plates, by stamping or perforation, and then taking impressions from such plate, on the paper or other fabric by means of a letter-press or other suitable press. Or, I engrave, that is to say, indent only, the letters, numerals, and other characters on sheets of metal, and take dry impressions therefrom by similar means.

Tenthly. I produce, for educational uses, colourless outlines of maps and other lineal designs in the fabrics of papers, after the manner of the ordinary trade water-marks. I take a sheet of wire cloth, or numerously perforated plate of metal, and work in or interweave the outline design with wire, or hair, or silk thread, or gutta percha thread. Or I produce the design on wire cloth, by laying on gutta percha, in a warm and plastic state, in streaks or larger masses, as required; or, by warming the wire cloth, and applying the gutta percha in a cold state. I use the wire cloth and perforated metal plates which have been thus prepared, to form moulds for making paper by hand, the mode of doing which is well known and understood. Or, I use the wire cloth with the designs embodied in or laid on it, in the ordinary way in which wire cloth is used in making paper by machinery. Or, I attach the piece of wire cloth containing the design to the upper surface of the continuous web, which carries the paper, or to a second endless web revolving above it, or to the surface of the dandy roller itself.

Eleventhly. For the purpose of guiding pupils in caligraphy, in giving the proper slope to the letters, and also to assist writers generally in this respect, I manufacture paper with guide lines embodied therein, also after the manner of water-marks. These lines are inclined from top to bottom at an angle corresponding with that which should be given to the letters in writing; and there are two sets of them crossing each other, one of which serves for the front side of the sheet, and the other for the back. I produce these lines in the course of manufacturing the paper, and while it is yet in a semi-pulpy state, by producing the corresponding figure on the surface of the ordinary dandy roller, in the manner before described.

Twelfthly. I produce, for various distinctive purposes in trade and business, paper with coloured lines, either vertical, or diagonal, or waving, and embodied more or less in the substance of the paper in the course of manufacture, so that they cannot be removed therefrom, except by processes and operations which would destroy the texture of the paper, and lead, consequently, to immediate detection.

Thirteenthly. I produce coloured outline devices in the body or substance of paper (similar to water-marks), by the same means as those last directed to be employed for producing coloured lines. But instead of having such devices worked into or superimposed upon the wire cloth of the dandy roller, these devices may be engraved, or otherwise produced upon the surface of a solid or hollow roller (which may be made of metal, wood, or any other convenient substance), or on a metal plate, which may be afterwards bent and affixed to the body of such roller.

Fourteenthly. My invention consists in the application of the several processes before described for the production of dotted and continuous outlines, to the producing generally of outlines of all objects that may be made the subject of lineal representation, and a knowledge of which, or skill in delineating which, may be promoted by means of such outlines, as, for example, the human figure, statues, buildings, machines, &c.

Claims.—First. I claim the producing of dotted outline maps on paper, pasteboard, parchment, papier-mâché, and other like fabrics, both colourless and in colours, by all and every of the means and methods described under the first, second, third, fourth, and sixth heads of this specification.

Second. I claim the producing of continuous colourless outlines on paper and other fabrics aforesaid, by the dry processes

described under the fifth head of this specification.

Third. I claim the producing of dotted and continuous outlines from gutta percha casts, as before described.

Fourth. I claim the employment, for the purposes of my invention, of the machine represented in fig. 1 of the engravings hereunto annexed and before described.

Fifth. I claim the producing of straight and curved lines (for outline purposes), by means of the machinery represented in fig. 2 of the engravings hereunto annexed and before described.

Sixth. I claim the making of perforated guide frames to assist persons in drawing lines of longitude and latitude, as before described.

Seventh. I claim the producing of raised outline letters, numerals, and other characters for the use of the blind, by the modes before described.

Eighth. I claim the producing of colourless outlines of maps and other lineal designs in the body or substance of papers, after the manner of water-marks, as before described, but only when such designs are used for educational purposes.

Ninth. I claim the producing of designs on dandy rollers by the application of gutta percha to the wire cloth of the dandy roller.

Tenth. I claim the producing of colourless diagonal lines in the body or substance of paper, after the manner of water-marks, for caligraphic purposes, as before described.

Eleventh. I claim the producing of coloured vertical, diagonal, and waving lines in the body of paper during the making thereof, for distinctive purposes in trade and business, as before described.

Twelfth. I claim the producing of coloured outline devices in the body or substance of paper, similar to water-marks, as before described.

Thirteenth. I claim the application to general purposes of so much of the several processes for producing dotted and continuous outlines, coloured or colourless, before claimed as may be applicable thereto.

[We earnestly recommend the preceding improvements to the attention of the Privy Council Committee on Education, and to all persons, in or out of authority, who take an active interest in the cause of education. We know of nothing better calculated to promote the acquirement of geographical knowledge and skill in artistical delineation, than Mr. Tait's outline maps and sketches, the dotted and colourless ones more especially. At the far-famed Rugby School they are already in authorized and universal use.—Ed. M. M.]

Christopher Nickels, Albany-road, Camberwell, gentleman. *For improvements in the manufacture of gloves and articles of dress and furniture.* Patent dated December 9, 1848.

Claims.—1. The manufacture of gloves of a fabric composed of woollen warp and silk, linen, or cotton weft, so as to give greater strength in the length.

2. The manufacture of gloves from cylindrical woven fabrics, cut so that the weft shall run in an angular direction from end to end.

3. The manufacture of articles of dress and furniture, of chenille, by weaving it in varying widths, so as to suit the different diameters required.

4. The manufacture of articles of dress or furniture, of chenille, made in one weaving, by cutting it in zig-zag directions to obtain the varying widths required.

5. The manufacture of chenille by bobbin-net or twist-lace machines.

6. The manufacture of chenille by warp weaving.

John Tutton, 20, South Audley-street, Grosvenor-square, mechanist. *For improvements in the construction and arrangement of certain parts of buildings.* Patent dated December 9, 1848.

This invention (?) consists in the construction of projecting windows of slate or iron, or of those materials combined together, and in the adaptation to the unglazed portion thereof of safety closets, or of water closets with a swing looking-glass and wash-hand basin.

Claim.—The construction of projecting windows of slate or iron, or of a combination of those materials, with safety and other closets; and the construction of water closets in combination with swing looking-glasses in such projections.

Edmund Hartley, Oldham, Lancaster, mechanic. *For certain improvements in machinery or apparatus to be employed in the preparation and spinning of cotton and other fibrous substances.* Patent dated December 11, 1848.

The object of this invention is—

1. To decrease the oscillation or vibration of the spindles in slubbing, and to allow of their running at greater velocities; and,

2. To dispense, by a new mode of working the "backing off" in self-acting mules, with some of the parts thereof.

1. The diameter of the upper part of the socket of the flyer is retained, as usual, while that of the lower part is diminished to suit the top of the spindle, and the arms of the flyer are shortened. The bevel wheel which drives the bobbin is fixed on a bush sliding on the spindle, and attached to the bearing.

3. An adjustable cam-wheel is substituted

for the horse-shoe spring and lever employed to work the "backing off" in self-acting mules.

Claims.—1. Decreasing the diameter of the lower part of the socket of the flyer to suit that of the top of the spindle.

2. Fixing the bevel bobbin-driving wheel to a bush on the spindle, instead of to the spindle itself.

3. A mode of working the backing-off in self-acting mules.

Andrew Lamb, of Southampton, engineer, and William Alltoft Summers, of Millbrook, engineer. *For certain improvements in steam engines and steam boilers, and in certain apparatus connected therewith.* Patent dated December 9, 1848.

☞ For specification and claims, see *ante*, p. 554.

John Gardner, of Wokingham, civil engineer. *For improvements in girders for bridges and other structures.* Patent dated December 9, 1848.

For specification and claims, see *ante*, p. 560.

William Palmer, Sutton-street, Clerkenwell, Middlesex, manufacturer. *For improvements in the manufacture of candles.* Patent dated December 9, 1848.

Claims.—1. A mode of manufacturing candles moulded at each end, and several of them upon the same wick.

2. A mode of coating or applying candle stuff so as to combine two or more wicks.

3. The manufacturing night and mortar lights in cases of woven fabrics, also in vessels of glass.

4. The manufacture of candles of less length than diameter.

5. The making of light and mortar candles with angular edges.

6. The employment of wick-holders.

7. The placing two or more wicks in one candle, placed at a distance apart from one another of five-sixteenths of an inch.

8. The winding of four wicks spirally upon a wire five-sixteenths of an inch thick or more.

9. The use of two or more compound or double wicks.

10. The use of two or more woven flat wicks.

11. Placing four or more wicks in two rows.

12. The application of holders to night lights, so as to hold the wick in an inclined direction.

George Lawrence Lee, Holborn, lithographer. *For improvements in producing ornamental designs.* Patent dated December 11, 1848.

The ornamental design is printed, or printed and painted, by type or blocks, with a mixture of lithographer's varnish, dryers, and colour, upon one or both sides of thin sheets of gelatine, which have been previously soaked in a compound of spirits of turpentine or wine, and some mastic varnish, to prevent the injurious action of the atmosphere upon them. The ground of the design is formed by painting it in opaque colours; and the effect may be in some cases heightened by quickening the back, or inserting mother of pearl, or by dusting some parts with flock, or coating them with metal leaf. In this case they are passed between rollers for the purpose of planishing the metal. The sheet of gelatine is then framed and glased, and the atmosphere excluded by pasting paper over its edges and those of the glass.

2. Letters and figures are printed in colours and varnished, after which they are to be applied to shops.

3. In order to produce an imitation of marble upon plaster and other surfaces, it is proposed to blend together the necessary colours upon the surface of water, contained in a suitable vessel, and then to dip the article therein.

Claims.—1. the mode of producing ornamental designs or surfaces by the employment of gelatine and glass, to which opaque colours are applied by printing and painting.

2. The quickening of the gelatine.

3. The employment of flock.

4. The mode of producing ornamental designs in the shape of letters and figures for shops, &c.

5. The mode of producing ornamental designs in imitation of marble on plaster and other surfaces.

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal.*]

For an Improvement in Ladies' Corded Skirts. *William E. Meginnis.*

Claim.—"What I claim as my invention, in the method of making ladies' self-adjusting skirts, is introducing in alternate order, threads or cords of manilla or other elastic material, twisted in opposite directions, with the cloth of which the skirt is composed, in alternate order, so that a thread or cord whose fibres are twisted to the left, shall counteract the tendency to kink of the next adjacent cord or thread, whose fibres are twisted to the right, by which the skirting is prevented from kinking, and by which the dress is retained in a proper position, whether the cords be composed of one or more strands, or made in any other mode which is substantially the same, by which analogous results are produced.

For an Improvement in Electrical Machines. *E. S. Blake.*

The patentee says,—"The characteristic

of my invention consists in employing for the electric a tube or cylinder of glass, supported by a fixed rubber which surrounds it, and in which it is to be moved back and forth in the direction of its axis, in distinction from the usual method of employing a glass cylinder or disk, mounted upon gudgeons or journals, supported in a frame and revolving about its axis. By means of this device, I am enabled to reduce the several parts of the apparatus to such form that they can be made at less expense, and packed in a case of smaller dimensions than the apparatus heretofore in use."

For an Improvement in Hollow Augers. *David George.*

The patentee says,—"The nature of my invention consists in arranging and combining with the machine in common use for boring round tenons, an adjustive sliding centring point, which being forced into the wood at the centre of the part of which it is required to form the tenon, guides the cutters accurately, until a sufficient length of the tenon is formed to enter the tube, after which it guides itself, independent of the centring point, in the manner of tools in common use for similar purposes. By the use of my invention, the operation of describing a circle upon the end of the piece on which the tenon is required to be cut, and then shaving the wood down to the circle to start the cutters, as is done in using the common hollow auger, is rendered unnecessary, and thus labour is saved, and the work is done with superior accuracy."

For an Improvement in the Manufacture of Velluted Cloth. *C.H. Brand.*

The patentee says,—"I take muslin, linen, or any other cloth made of cotton or linen, fasten it with cords on frames; then I take a smooth piece of pumice stone and rub the same off with it. When this is done, I apply to it, with a couple of large round knives or brushes made for this purpose, a composition made as follows:—I take 4 gallons of linseed oil, in which a quarter of a pound of India rubber has been dissolved, (which is done by putting it for about three hours on a strong coal fire,) when I add a quarter of a pound of bees-wax, and boil it again half an hour; after this, I add about a quarter of a pound of gum elemi, and boil it a quarter of an hour; then I add 1 lb. of syrhalt, boil it again for about half an hour; and then, at last, I add 2 lbs. of fine lamp black, mix it well together, and boil this again for about half an hour.—This, when cold, is applied. When I have given the cloth a coat of this mass, I put it into a warm place to dry. I take water and put it on the cloth, and then I take pumice stone and rub it off with the water, dry it again, and give it another coat as before, and treat it in the same manner. When this is done I apply to it a coat of the following composition, very thin and even:—I take 1 lb. of gum copal, melt it in a suitable vessel, add to it 1 lb. of linseed oil, in which 1 oz. of India rubber has been dissolved; then I take half a pound of japan, and 1 lb. of spirits of turpentine, add it, and let it get cold for use. I take ground flock, throw it over the cloth, and beat it from the underside with a couple of sticks, till the flock has settled."

WEEKLY LIST OF NEW ENGLISH PATENTS.

Joseph Samuda, of Parliament-street, Westminster, gentleman, for improvements in obtaining motive power, and the machinery or apparatus employed therein, which machinery or apparatus may be used for raising liquids. (Being a communication.) June 9; six months.

William Preddy, of Taunton, Somerset, watchmaker, for improvements in watch keys, and other instruments for winding up watches and other time-keepers. June 12; six months.

Joseph Wade Denison, of New York, gentleman, for improvements in engines for raising or forcing liquids. (Being a communication.) June 12; six months.

Joseph Burch, of Craig Works, Macclesfield, engineer, for improvements in printing on cotton, woollen, silk, paper, and other fabrics and materials. June 14; six months.

Peter William Barlow, of Blackheath, civil engineer, for improvements in parts of the permanent ways of railways. June 14; six months.

Michael John Haines, of John-street, Commercial-road, East, leather-pipe maker, for improvements in the manufacture of packing for steam-engines, cylinders, and other purposes, part of which improvements are applicable to the manufacture of waterproof fabrics and leather. June 14; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
June 7	1918	John Holmes	Norwich, Agricultural Machine Manufacturer	Manure distributor.
"	1919	John Holmes	Norwich, Agricultural Machine Maker	Self-adjusting horse hay rake.
9	1920	Nathaniel Jones Amies	Manchester, Braid Manufacturer	A hollow braid spindle.
12	1921	Richard Hervey	London-street, City	An oval chimney top.
"	1922	James Macnaughtan	Glasgow, Mechanic	Spindle bearing.

NOTICES TO CORRESPONDENTS.

Davies's Rotary Engine.—*The reply of Mr. Davies to "Z." is withdrawn by the writer, who "Considers that 'Z.' is sufficiently answered by the clear and conclusive remarks of Mr. Dredge," which he (Mr. Davies) had not seen at the time of pennin; his own observations.*

M. M.—*Will be inserted at the first convenient opportunity.*

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

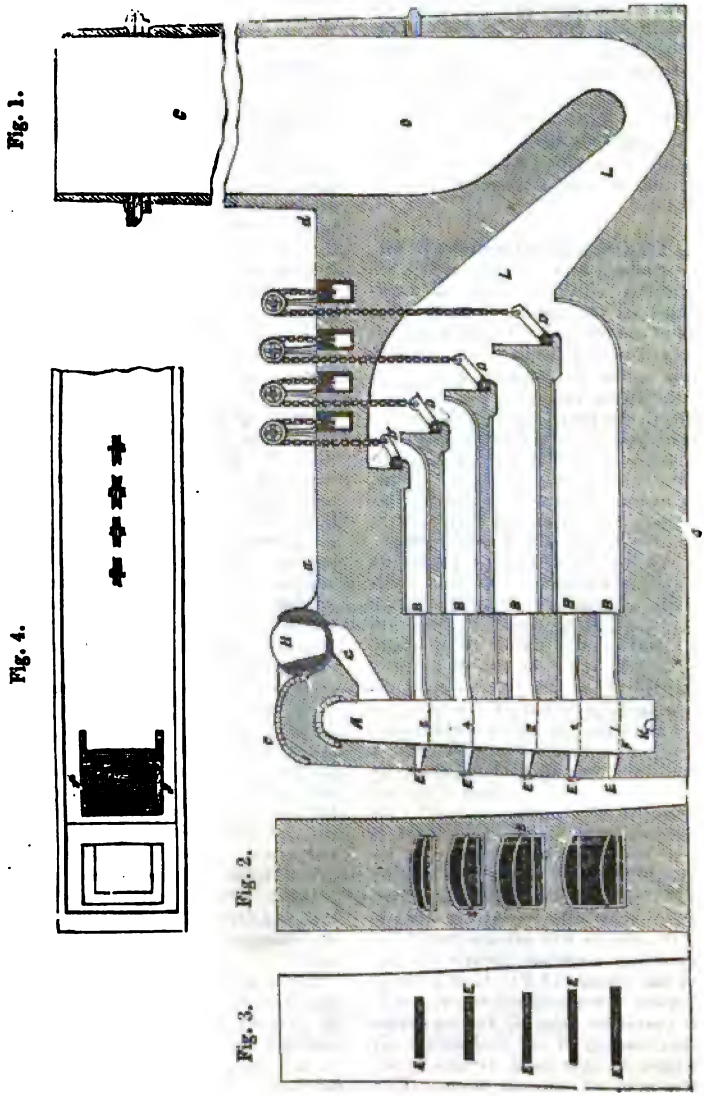
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1350.] SATURDAY, JUNE 23, 1849. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

DEELEY'S PATENT IMPROVEMENTS IN FURNACES FOR SMELTING IRON ORE, AND MELTING IRON.



DEELEY'S PATENT IMPROVEMENTS IN FURNACES FOR SMELTING IRON ORE AND MELTING IRON.

[Patent dated December 16, 1848. Specification enrolled June 16, 1849. Patentee, Joseph Deeley, of Newport, Engineer and Ironfounder.]

The general object of Mr. Deeley's improvements is to supersede the use of blowing machines in the reduction of iron ores and melting of iron, and thereby to facilitate and reduce the cost of these operations. He accomplishes this by constructing the furnace in such manner that it shall, so to speak, be its own blower; auxiliary to which end he employs a new and very ingenious sort of hopper, which feeds the furnace without the usual accompaniment of an inflow of cold air at a point where it is not wanted, and is always more or less injurious.

Figure 1 is a longitudinal section of a furnace for smelting iron ore constructed according to this invention. Figure 2, a vertical section on the line *a b* (looking from the back of the furnace). Figure 3, a front elevation exclusive of the chimney, and with the doors of the air-passages, E E, afterwards mentioned, removed; and fig. 4, a top plan of the part from *c* to *d*. A F is the furnace proper, or part appropriated to the fuel and iron ore. It consists interiorly of but one open space from top to bottom, but may be considered with reference to the series of lateral air-passages, E E, and the longitudinal vapour and smoke-passages, B B—which two sets of passages are exactly opposite to one another—as divided transversely into five stories or compartments of gradually diminishing elevation from the bottom upwards, as indicated by the dotted lines, 1, 2, 3, 4, 5. Both sets of passages (E E and B B) have doors or dampers attached to them (with the exception of the lowest of the series, E, which is always left open) and each damper is provided with a weighted chain passing over a pulley, by means of which it may be closed or opened at pleasure to any extent required, (one series only of these chains and pulleys, is shown in the engravings, namely, those attached to the doors of B B, and which are marked D D). G is the feed mouth, which is made of larger diameter at top than at bottom, in order to increase the gravitating tendency of the materials towards the interior of the furnace (A F); H is a barrel hopper, which is enclosed within two semicircular guards or casings, I, and covers lengthwise, the top of the feed-mouth, G, so as to leave as little room as may be for the entrance of air between them. This hopper is suspended from two end axes, or pivots, *f f*, (see fig. 4,) on which it is free to turn; and it is made of such a form in its cross section, that the space above the axial line is of larger contents than that below it. On the side which, by this arrangement of the axial line must always be thrown uppermost when the hopper is empty, it is left open, and through this open side the fuel and ore are dropped in. As soon as the hopper is filled, or the quantity of materials in the upper portion preponderates over that in the lower, the hopper turns over of its own gravity, and empties itself into the feed-mouth, G, whereupon, the hopper immediately returns to its original position, and is ready to receive another charge. The hearth, or bottom of the furnace part (A F) is provided with a dam-fall and tapping-hole, K, in the same way as the common blast furnace, for drawing off the clear metal.

From the preceding description it will be seen, that—by means of the front air-holes, E E, and the smoke and vapour passages, B B, at the back, and the provision made for opening and closing these passages, all, or any of them, and to any extent desired—the heat may be regulated to any degree of intensity, and for any length of time requisite, not only within the entire furnace, but at any particular division or compartment of it. For example, supposing the furnace part to be fully charged, and that it is required in the first instance to diffuse a considerable degree of heat throughout the entire mass, all the front air-passages, E E, are thrown wide open, while the lowest of the doors, or dampers, D D, of the smoke and vapour passages is quite closed, and each of those above it is only partially opened. But afterwards, in order to increase the intensity of the heat towards the bottom, where the ultimate fusion of the metal takes place, the upper doors, D D, are successively closed, or nearly so, and the undermost one, D, which was previously quite closed, is thrown wide open.

The smoke and vapours escape from the passages, B B, through the doors or valves, D D, and are conducted by a curved descending passage, L L, into the upright chimney, C.

Fig. 5 is an external side, or end elevation of a pair of furnaces for melting iron for foundry purposes; fig. 6, a transverse sectional elevation on the line *ab*, of fig. 5; and fig. 7, a plan on the line *c d*, of fig. 6.

A A are the two furnaces; one on each

side of the common chimney, C. The furnaces are precisely alike, so that a description of one will suffice for both.

F is an upright hearth of about 4 feet in length, 3 feet in width, and 4 feet in depth from front to back. On this hearth the fuel is laid. B B are air passages, which are made in the sides of the hearth, and provided with one-way taps or cocks, *c c*, by which they may be opened or closed as required. D is an aperture at the bottom, which is stopped with sand or clay, and E, a tapping hole formed therein, through which the hearth is cleared in the same way as the ordinary cupola furnace. G is an inclined plane, or ledge, on which the iron to be melted is laid, and over which the heated vapours ascending from the hearth pass in their way to the chimney, C. H is an arch which subtends in its span both the hearth, F, and the inclined plane, G, and forms the space between G and H, into a sort of oven for the heating of the metal. The fuel and metal are supplied from a mouth-piece, L, and barrel hopper, M, of the same description precisely as those employed in the furnace first before described; that is to say, each charge of the hopper, L, consists partly of coke or other fuel, which is placed at the end, which comes immediately over the hearth, and partly of metal, which is placed at the other end, which comes immediately over the inclined plane or ledge, G. M' is a door through which the metal, as it becomes heated upon the ledge, G, is pushed over by a rake or other suitable tool, into the midst of the burning fuel on the hearth.

Fig. 5.

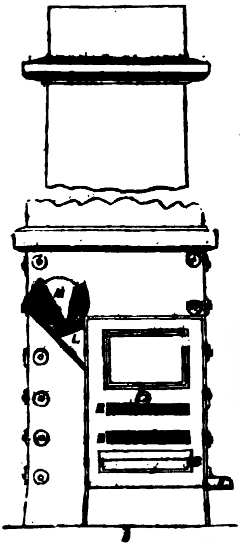


Fig. 6.

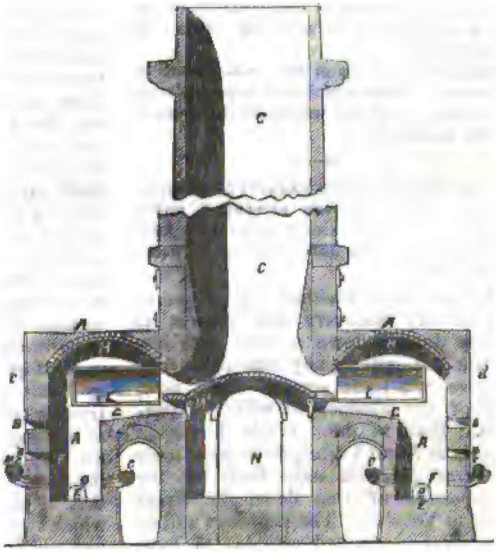
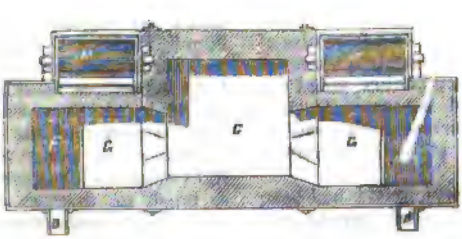


Fig. 7.



N is a roadway under the chimney by which access is obtained to the doors, M'M', on either side.

Claims.—Having now described the nature of my said invention, and in what manner the same is to be performed, I declare that the

improvements which I claim as constituting my said invention, are as follows:—

First. I claim the construction of iron ore smelting furnaces, with air, and smoke, and vapour passages, placed, and arranged, and provided with doors (except as before excepted) for closing or opening the same, each independently of the others, and with air-tight, or nearly air-tight, supply hoppers, all as before described; but without confining myself to the number of air, and smoke, and vapour passages, represented in the engravings, or to the precise cross-sectional forms given to these passages.

Second. I claim the construction of iron melting furnaces of the oven-like form before described, that is to say in so far as regards the combination of the parts, F, G, H, and M, in the manner shown.

Third. I claim the application of the said oven-like form of construction to all ovens and furnaces to which the same may be applicable.

And, *fourth*, I claim the employment in ovens and furnaces of barrel-hoppers, constructed, applied, and worked in the manner before described.

ON THE COMPARATIVE VELOCITY OF LIGHT AND HEAVY BODIES FLOATING DOWN RIVERS. [FROM AN UNPUBLISHED LETTER OF THE LATE BRIG.-GEN. SIR SAMUEL BENTHAM.]

I don't know whether I told you or not of my discovery with respect to bodies floating down a river with the stream. I will at any rate endeavour to give you some account of it now, and of the manner in which it suggested itself to me. While I was in Siberia at Nigni Taghil, there were some barks of different sizes built for the transporting of iron down the rivers there to Tobolsk. The people in authority there, happened one day to have occasion to speak of the advantage with respect to expedition, which the larger bark would have over the smaller one. This appeared to me to be a false idea of theirs, the more so, when upon a stricter inquiry, I found they neither sailed nor rowed, but received the whole of their motion from the current itself, and an oar at the head and at the stern only to guide them.

I reasoned with myself as I had been accustomed to find other people and authors reason on the subject. Any body floating in a running water, when first set off, receives an impulse from he water till having required the same velocity with the current itself it is no more struck by it, but becomes, as it were, a part of that current, and like the quantity of water which it displaces (occupies the place of) can move with no other velocity than precisely that with which the current itself moves. On this account, a great body and a small one, be the weight and figure what they will, so soon as they have been long enough afloat in the current as to have acquired its velocity, must move equally swift; excepting any influence which the different velocities which one part of the current may have compared to the other, as also the influence of any extraneous force, as that of the wind, may have on one more than on the other. A cork and a first-rate man-of-war I have always been told, go down the Thames with the same velocity when there is no wind: I told them so; but their experience had taught them better than to believe me. They assured me, a greater bark would pass by a smaller one, although both were of equal depths in the water, and that the shape also made a difference. Both parties were obstinate, each in his own opinion, and no opportunity then offered itself to decide the matter by experiment. Indeed I was too fully persuaded that the difference, if any, in the velocities, must depend upon the wind, or some such foreign power, to think the experiment worth trying.

It happened however, the year after, as I was descending the river Angora from Irkutsk to Yenescisk, that a regret at passing by a delightful scene, made me take notice of the velocity with which the bark I was in moved, compared to that of the bubbles and piece of wood which swam on the surface of the water, and which made, as well as the bark, a part of the current. I was astonished at this phenomenon, and presently recollected my dispute with the people at Nigni Taghil. I made the men row backwards against the current till all the light substances floating on the surface passed by us, then ceased the rowing, when I perceived the bark by degrees acquiring the same velocity as these light substances, and soon after a greater, so much so, that we appeared to pass by the light bodies nearly as fast as they passed by the land. Not a breath of wind was stirring. I got into a small boat and put off from the bark. In a short time I was left behind, and it was

not without a good deal of rowing that I could keep pace with the bark where there was no rowing.

The fact was too plain to be denied,—the cause of it, not so ready to be found. It was not the depth that made this difference, for this large bark was very shallow, being flat-bottomed. At length, however, I explained the matter to my entire satisfaction.

Rivers consist of water running down an inclined plane by the force of gravity. Were it not for the resistance the water meets with in the bed of the river, as well at the bottom as at the sides, the water would run down infinitely faster.

Bodies floating in this running water are acted upon also by the force of gravity; they have a tendency to move with as great a velocity as that which the water itself would have, had it met with no resistance against the bed of the river. These floating bodies do not touch the bed of the river; their motion is not impeded, till we come to consider the resistance they meet with in the water itself. But they meet with none till their motion exceeds that of the water. Their motion then must exceed that of the water, and that the more so the less they are affected by that resistance: hence, the better their shape is adapted to divide the water, and the greater proportion their gravity bears to their surface of resistance, the quicker they will be impelled by their gravity through the medium which tends to retard their motion. They would acquire, were it not for the resistance they meet with from the water, precisely that degree of velocity which the water itself would acquire, were it not for the resistance it meets with from the land.

THE BENZOLE LIGHT.

Sir,—Several notices of the discoveries and inventions of Mr. Mansfield have appeared in your columns. The papers containing them come from his own pen, and with a proper modesty he has refrained from praising his own works to the extent that might be done by another. Even had he favoured us with his opinions, it is but a reluctant attention which is given to eulogies of an invention when these are supplied by the inventor.

I have had many opportunities of observing Mr. Mansfield's new patent light, and of examining the apparatus by which he applies it to the various circumstances in which it may be useful.

The simplicity of the means he employs appears to be a great advantage; for an absence of complexity is a *sine quâ non* in the construction and management of apparatus intended for domestic use. To render common air the vehicle for bearing luminiferous vapour is a highly philosophical idea. Personal inspection will satisfy those who make use of it, that this idea has been as well carried out into practice as it has been happily conceived.

Whilst this light obtained from the diluted vapour of Benzole is more particularly intended for use on a small scale, it must be remembered that it can be applied even more extensively than coal gas. For, the time occupied in filling a gasometer with gas as an occupant, will suffice to fill and empty it many times, when the atmosphere which costs nothing is the material employed.

A table-lamp standing on a crown piece affords a brilliant light when made on this construction, yet the largest city may be lighted by a corresponding extension of the apparatus. As the electric light is pre-eminently adapted for great central foci, Mr. Mansfield appears to have occupied the only field thus left vacant, by supplying a cheap, simple and safe light for isolated dwellings, such as ships, private houses, and especially all detached localities where coal is dear. We can recognize, I think, a similarity in principle, between the portability of the requirements for this light and the same property belonging to the concentrated essences of tea and coffee so often brought before the public. In these you may carry in a small compass provision for a month, readily convertible into potable fluid by the addition of water. The material used by Mr. Mansfield, equally portable, needs but to be diluted by the atmosphere to expand it into an excellent light, and I might wish that the beverages prepared as above were always as agreeable to the palate as this light is to the eye.

By mixing various substances with the fluid Benzole, I suppose it probable that coloured lights might be produced, which would enhance its use in theatres, and in exhibitions at other places. I am not aware whether Mr. Mansfield has turned

his attention to this part of the subject. It is merely an ornamental and a subordinate application of the means. The first requisite is already secured by his mode of obtaining a powerful white light, pleasing the eye by its purity, the nose by its freedom from smell, and the touch by its cleanliness; pleasing to the pocket by its cheapness, and the temper by its simplicity. Yours, &c.

JOHN MACGREGOR.

24, Lincoln's-inn Fields, June 15, 1849.

MESSRS. MAIN AND BROWN'S "MARINE ENGINE."*

The writers of this work (Professor Main, of the R.N. College, Portsmouth, and Mr. Thos. Brown, Chief Engineer, R. N.) preface it by the following very sensible and all-sufficient apology for its appearance :—

Existing works on steam are generally deficient in maxims for the management of engines in the various circumstances of difficulty and doubt in which steam vessels, whether of the navy or the merchant service, may be placed. These, however, are the ends for which practical men read such works. When at sea they are necessarily thrown on their own resources in every emergency, and therefore a sound rule, framed by experience and previous reflection, is of more value than a scientific investigation. It can matter but little, practically speaking, to the captain or engineers of a steamer, whether side-lever or direct-acting, oscillating or trunk engines, are preferable, or whether the paddle or screw have the advantage as an instrument of propulsion; but it does matter very seriously to them, that they should be capable of tracing the imperfect working of an engine to its right cause, and be able to remedy any defect; that they should be skilled in the modes of economising fuel, on which the efficiency of a steam-vessel mainly depends; and that they should, by a due knowledge of the skilful management of engines, and of the relation of their parts to each other, be able to diminish the inconvenience of a gale of wind, and be prepared against the accidents of an engagement. Impressed with this view, the authors have endeavoured to give a practical tendency to their work throughout, without, however, neglecting the considerations which are due to science. While the reader who has not had the advantage of a mathematical education will be able to peruse the work as far as the Miscellaneous Chapter without meeting with an obstacle to its full comprehension, the scientific reader will find in notes, and at the end of the work, the investigations of the rules.

To be convinced of the truth of what the authors say as to the deficiencies of "existing works," it is only necessary to take a glance at the "Contents" of the present. To which amongst the best of them, for example, could a practical man refer for guidance, in such cases as are indicated by the following heads of sections?

How to Work the Engines at Moorings before starting. Whether the Vessel may start before the Steam is well up?

Steaming through a difficult Passage on first starting.

To ascertain on board a strange Steamer if the Throttle-valves or Blow-off Cocks be open or shut.

Method to adopt in case the Blow-off Cocks set fast, and Force Pumps are not fitted.

Number of Boilers to be used when not going at full speed.

On Leaks in the Engine and their remedy.

Preparatory orders before stopping the Engines.

On the regulation of the Fires during action.

On the casualties to which Paddle-wheels are liable during action.

On the general effect of Shot upon Funnels.

Remedies to be adopted in case a Shot enters the Boilers.

To work with one Engine if the other be disabled.

Method of working the Engines without Cylinder-covers, in case they are broken by accident.

On getting up the Steam occasionally when in Harbour, and the services of the Engines are not required.

The instructions given on these points—as, indeed, on every one treated of in the course of the work—are all admirably adapted by their plainness to general comprehension, and illustrated by many a striking instance drawn from actual service. Here Mr. Brown's extensive personal experience has been of great use. We quote a few examples :—

* The Marine Steam Engine, Designed chiefly for the Use of Naval Officers and Engineers. 338 pp. 8vo. With numerous Plates and Woodcuts. Hebert, Cheapside; and Woodward, Portsea. 1849.

Danger from the Choking-up of the Injection Orifice by Ice.

Mr. Brown, one of the authors of this work, was once placed in a very trying position while engineer of a steamer in the Thames. The vessel was trying to force her way through a floe of ice; and, when just in the midst of it, she stopped for want of water to condense the steam; for in those days the steam-pressure was so low in the boiler, that the engines could not be worked without injection water. The steam, however, was blown through the pipe, and it thawed the ice so as to admit the water again. The vessel was but a small one, and consequently the orifice not far below the surface, and the steam-pressure in the boiler overcame the column of water. There may be some difficulty at times in discovering whether the orifice is cleared; for the injection-pipe will get so hot that the injection-water cannot enter, and we shall therefore be led to suppose the orifice is still choked up. If, however, there be any suspicion of this, shut the blow-valve, and apply the hand to the outside of the pipe; and if it be found that the pipe is cold near the ship's side, and as we pass the hand along we suddenly arrive at a part where the steam still keeps the pipe hot, we may be certain that the water and steam are struggling for the mastery, and that eventually the water will make its way. Its progress will be expedited by the application of cold water to the outside of the pipe and condenser.

Steaming through a Difficult Passage.

If the vessel have to steam through a difficult passage on first starting, she should not be allowed to get under weigh till after the steam has been up some time; for to neglect this precaution may be attended with dangerous consequences, because, as was before stated, unless the expansive gear or throttle-valve be attended to, the steam will fall in the boiler, and the engine will stop, perhaps at the very time it is wanted to exert its greatest power. The better plan is to give the engines a few turns at the anchorage, or at moorings, before starting, so as thoroughly to heat them; and at the same time to have the steam well up in the boiler: if this be done, and the feed shut off for a few minutes, the boiler will keep its steam, unless it have some radical defect. As a case in point, the *Comet*, when on the north coast of Spain, was ordered out of Passages on an emergency; and the distance from the anchorage to the mouth of the harbour was just sufficient to run the steam down, because she started as soon as it began to blow off. Hence the engine as nearly as possible stopped; and it unfortunately happened, as it was blowing hard, with considerable sea, that just as the vessel opened the rocks she plunged so deeply into the sea as to immerse the wheels nearly to the shaft: this brought a great additional load on the engine, which consequently barely turned the centre: the engineer, however, shut off the injection suddenly, and prevented the engine filling with water; and the momentum of the engines (being beam-engines) brought her out of the difficulty, otherwise she must have gone on the rocks, and been lost to the service.

Necessity of being on the alert.

It may be as well here to bring forward an instance to show how easily accidents may happen unless the engineers are on the alert. H. M. S. V. *Comet* was coming over Bilboa bar with a cutter in tow. It was a beautiful day, and quite calm, with scarcely a ripple between the pier-heads; but just as she was on the bar, a heavy roller set in, and before the vessel could rise to it (although a good sea-boat), the sea broke on board her. It then came down the hatchway, over the cylinders, into the engine-room; and what with the extra work the paddles had suddenly to contend with, and the condensation of the steam in the cylinders from the application of the cold water outside, the engines completely stopped for an instant. Fortunately the engineer was at the time between the engines, and shut off the injection water, otherwise they would have choked up with water, and would not have again recovered themselves. The consequences of losing the moving power at such a time may be easily imagined. The same thing is likely to happen at sea, particularly in small vessels.

In the "Miscellaneous" Chapter referred to in the extract which we have given from the Preface, we meet with the following useful information on the rule adopted at the Admiralty in the calculation of horse-power:—

It is necessary to have some definite rule for gaining an idea of the power of an engine to be constructed, otherwise contracts could not be entered into between the manufacturer and the party for whom the engine is to be made. And therefore in sending in tenders for engines for Her Majesty's ships, the calculation of the power is made by allowing the effective pressure on each square inch of the piston to be 7 lbs., and the speed of the piston as follows:—

For	3 ft.	0 in.	stroke,	30	revolutions	per min. =	180	ft. per min.
	3	6	,,	27	,,	,,	189	,,
	4	0	,,	$24\frac{1}{2}$	,,	,,	196	,,
	4	6	,,	$22\frac{2}{3}$	,,	,,	204	,,
	5	0	,,	21	,,	,,	210	,,
	5	6	,,	$19\frac{1}{2}$	,,	,,	216	,,
	6	0	,,	$18\frac{1}{2}$	,,	,,	222	,,
	6	6	,,	$17\frac{5}{13}$	,,	,,	226	,,
	7	0	,,	$16\frac{1}{2}$	,,	,,	231	,,
	7	6	,,	$15\frac{11}{15}$	,,	,,	236	,,
	8	0	,,	15	,,	,,	240	,,
	8	6	,,	$14\frac{6}{17}$	,,	,,	244	,,
	9	0	,,	$13\frac{2}{3}$	,,	,,	247	,,

And hence the following rule adopted by the Admiralty for horses-power:—

$$\frac{7 \times \cdot 7854 \times d^2 \times \text{feet per minute}}{33000},$$

or,

$$\frac{d^2 \times \text{feet per minute}}{6000} = \text{nominal horses-power.}$$

An "Appendix" contains, among many very serviceable Tables, one of all the paddle steamers of the Royal Navy (124), the names of their builders and engine makers—kind of engine, boiler, and wheel used—consumption of fuel—immersion of wheels—steam pressure, &c.;—a similar Table of the screw steamers 28), and a third of the steamers building (34).

The work does, altogether, great credit to its authors, and must, of necessity, find its way not only into every steam-ship library, but into the pocket of every one personally engaged in steam navigation. To the marine engineer it is precisely what Norrie is to the ordinary seaman;—a book to be examined by, a book to take with you for every-day reference and counsel, and a book to be relied on under all possible circumstances. Sure of great success, for this best of all reasons—that it is one which people cannot, if they would, do without.

ON ZERO SYMBOLS.

Sir,—I beg to hand you the following letter from my friend, Professor J. R. Young:—

To James Cockle, Esq., M.A., Barrister-at-Law.

Belfast, June 9, 1849.

My Dear Sir,

As you already know, I have of late been too much occupied about very different matters, to give any attention to your late correspondence with Mr. Harley on the subject of zero symbols, beyond mere reading the printed transcript of it, in the *Mechanics' Magazine.*

I do not know that I have anything more to say in reference to it; except to thank Mr. Harley, very sincerely, for the kindly and far too liberal opinion he entertains of your humble servant.

I suspect we differ less in our *views*, than in the *subjects* of them. *I* regard as all-important what Mr. Harley dismisses as of no moment: what I seize upon, as the only essential item of consideration, your correspondent wholly dismisses; for he says, p. 462, "the first of these results (the zeros) having 'totally different origins,' appears to me in no way to affect this question." Now, if you present to me a bald zero, I can make nothing of it: you will say "true, for that is all that *is* to be made of it:" but what I mean is, that if there be no information, as to what that zero is the trace of, I cannot reason upon it: in fact I am not occupied with the mere symbol of exhaustion, but with whatever indication it may afford, as to how that exhaustion was occasioned. When Robinson Crusoe was arrested by the footprint on the beach, he surely was not engaged in contemplating the mere empty form or outline: it became interesting to him because it enabled him to infer *a man*:—so with these symbols:—let them only be accompanied with a *plus*, or a *minus*, and they at once become sug-

gestive: you then see, as it were, the *foot-print* of departed quantity; and these *ghosts*, as Berkeley facetiously called them, become communicative ghosts; and furnish information, as to the departed reality. Now, this sort of information has been, and will continue to be, a fertile source of scientific discovery: we owe to it the important theorem of DE GUA, in the doctrine of equations; and the analogous theorem of FOURIER—called by him "the rule of the double sign." These theorems are founded upon the contemplation of zeros, not indeed zeros stripped of all significance—for of these, as I have said above, we can make just *nothing*: but of zeros, accompanied with the mark of what they once were—as to positive or negative: that is, we are made acquainted with their *origin*.

As I noticed, in my former communication, these zeros often occur in inquiries where quantity *only* is what we are concerned with, no condition or restriction being imposed as to its mode of generation.

In that case, the plus or minus, before a resulting zero, though equally significant, becomes unimportant; inasmuch as we are interested only in absolute value; the same is true as to quantity in general:—when nothing as to generation or mode of origination is stipulated for. If you ask me what is the square root of a^2, I answer a: I can merely give you the *value* that has generated a^2; and can say nothing as to attribute, or peculiar character: but if you ask me for the square root of $(+a)^2$, or of $(-a)^2$, then I can tell you all about it; and can reply, explicitly, $+a$, or $-a$.

Now, no one knows better than yourself—I may indeed say, no one knows so well as yourself—that in the theory of congeneric equations, out of which this correspondence about zeros arose, these *plus* and *minus* appendages are the very things, upon the strict observance of which, that theory derives, mainly, its existence: deprive the symbol of operation, $\sqrt{}$, of an express and distinctive sign, and consider the choice of one or the other as "in no way to affect the question," and, of course, that theory becomes destroyed. And all that has followed from this theory about the zeros, *necessarily* follows from keeping to the original stipulations as to *sign*, as well as *quantity*, throughout every step of the reasoning to the final conclusion: and whether that final conclusion be 0, or any other numerical symbol, it is still entitled to the sign significant of its origin, or descent; and is deprived of its due if written without it. As before admitted, this *may* be of no moment; but the omission may, on the other hand, lead to great error, and great absurdity, as was noticed in my last.

I do not think I have made the oversight which Mr. Harley seems to suspect I have, by his remarks at p. 463: I cannot discover any error: nor can I see how, from the false statements $+0=-0$ and $+\infty=-\infty$, "it by no means necessarily follows that $2\infty=0$": to me the conclusion seems inevitable. But I eschew controversy; and, although I am sure that, in Mr. Harley, I should have a generous antagonist, yet it is better that I should now dismiss the subject.

Before I do so however, it would perhaps be well—in order to prevent any misunderstanding, as to what Mr. Harley conceives to be a flaw in my reasoning in reference to $+0=-0$—that I should show distinctly the marked difference there is between that reasoning and Mr. Harley's argument from $3\cdot0=2\cdot0$.

This latter equation I regard as strictly true, and as justifying subsequent deductions, only on the hypothesis that the zeros are *not identical*. Should any one deny this, and maintain that they *are* identical, I should, of course, pronounce the equation to be untrue, just as unhesitatingly as I should pronounce $3a=2a$ to be untrue, without any inquiry as to the value of a. Such being the case, I cannot but affirm the addition of $2\frac{1}{2}\cdot0$ to each side to be inadmissible.

The equation $+0=-0$, I have all along held to be absurd; because, as we are confessedly reasoning in reference to *signs actually expressed*, I do not imagine that the proposer of this equation presents the *minus* to the eye, and conceals another minus in the zero. To prove this absurdity, I reason from the statement as if it were true; and am legitimately led to $2\infty=0$, where the absurdity is palpable, however disguised it may have been before. The true processes of deduction are thus entirely different.

I remain, my dear Sir,
Very faithfully yours,
J. R. YOUNG.

The mathematical readers of this Journal will doubtless agree with me in thanking the eminent writer for the remarks which he has just brought to a conclusion.

I am, Sir, yours, &c.

JAMES COCKLE.

2, Church-yard Court, Temple,
June 18, 1849.

Correction.—*Supra*, p. 559, note to 1st col., *for* by *read* $b\,y$

MR. RUTTER ON GAS-LIGHTING AND THE ELECTRIC LIGHT.*

Mr. Rutter has written very cleverly on gas-lighting before, and so many thousands of his little works on the subject (*Advantages of Gas-light in Private Houses*, and *Practical Observations on the Ventilation of Gas-lights*) have found their way into circulation, as to make his name familiar to every one who has bestowed a thought on the subject; but, in our judgment, he has written nothing upon it before, half so good as this, or so certain of universal acceptance.

Very truly does he say that he has not in this new production of his pen, "assumed the office of an advocate or an apologist!"—"My sole purpose has been to exhibit that which I know, or believe to be the truth." So characteristic is this truth-seeking of our friend's style of writing, that it amounts to a mannerism, which no one would hardly venture to condemn, yet every one may freely own to have rather a perplexing effect on the understanding. If Mr. Rutter has any thing good to say of this or that, it is invariably accompanied with a set off to some extent more or less of an opposite character. He thinks the recent outcry against gas monopoly (as we do) senseless, yet is decidedly of opinion that the gas companies have by no means done their duty to the public. He extols the wet meter as no one has done better or more justly before him; yet has a wonderful deal to say in favour of the dry. He thinks gas lighting has nothing to fear from electric lighting; yet has many kindly and encouraging things to say of the latter. From every quotient he has a deduction—for every result a rectification—for every compliment a banter. Wherever there are two sides to a question, we have the ancient *contre-danse* of Sir Roger de Coverley over again; and even when, according to the new political logic, a question of three sides turns up, he is never at any loss to establish a good footing for the third in the fray. The rule in which Mr. Rutter seems to delight, is, to find some good, some evil—in every-thing and everybody. He would, no doubt, condemn the devil in the abstract, and yet pronounce him a capital *Vice-President* of the Society for the Promotion of Christian Knowledge. There is much of truth, and a love of truth, doubtless, in all this; yet it is truth with a dryness. We should probably like him better were he more of either the one or the other—that is, of "the advocate" or "the apologist,"—just in the same way, as we listen in courts of justice, to an impassioned appeal from the bar, with double the relish which we do, to a calm summing-up from the bench.

And after all that can be said in favour of a rigid impartiality, why should we shrink from enlisting the feelings on the side of truth, when once clearly ascertained? Ought the feelings to be the sworn servitors of vice and error alone?

Mr. Rutter's "mannerism," as we have presumed to call it, is accompanied throughout with a most redeeming degree of shrewdness and terseness, distinguished not unfrequently by a pleasant quaintness which puts one in mind of the elder essayists, such as Taylor, Burton, and Hall. We have no fault to find with any of his positions—none at least which is worth insisting on here—and all that remains to us, therefore, is to recommend the following specimens of the quality of the work to the favourable attention of our readers:—

The Gas-meter and its Inventor.

Let not the meter be mentioned without associating with it the name of its inventor, SAMUEL CLEGG. That a machine so entirely new in its construction and its objects should be perfect at once, is more than could be expected. Rough, and in some parts a little complicated, as it then was, it furnished a remarkable illustration of the common proverb, "Necessity is the mother of invention." Now that the meter is complete in all its parts, and we have so long been familiarized with its operations, it is as impossible to understand the difficulties which beset the path of its inventor, as it is

* "Gas-Lighting — its Progress and its Prospects. With Remarks on the Rating of Gas-Mains, and a Note on the Electric-Light." By J. O. N. Rutter, F.R.A.S. 63 pp. 8vo. Parker.

to overrate the skill which contrived, and the perseverance which completed, that beautiful machine. Many changes, and many improvements, have been made, both in the external form, and the internal arrangements of the meter, since it first came out of the hands of Mr. Clegg, and was by him transferred to those of a man equally deserving of being remembered—the late Samuel Crosley. But the principle is the same in all, whatever be the variations of form, or other details of construction; and experience has shown how admirably adapted is that principle to the work the meter has to perform. Set in motion by an impulse less powerful than the breathing of a new-born infant, and discharging the duties assigned to it with the fidelity of a tried servant, and the accuracy of a skilful accountant, the meter may truly be described as the offspring of genius, well instructed by philosophy.

To find fault with the meter is easier than to improve it. Many persons abuse it, and almost always for its honesty. It enjoys the confidence of all who have taken the pains to make themselves acquainted with its movements. If there be any one who still have misgivings concerning its capabilities, let me advise them to devote only one-tenth part of the time to an examination of its merits, which they have spent in searching for defects, and all their objections will be satisfactorily answered, and their doubts entirely removed.

Those who think, or speak, slightingly of the gas meter may with great propriety be required to tell us in what other department of trade or manufactures goods are measured, or weighed, with anything approaching to the accuracy or disinterestedness with which gas is measured. In other branches of trade, whatever may be the accuracy of the instruments, or the care of the attendants, weighing and measuring, whether in large or small quantities, are interrupted processes; and consequently there is waste, loss, and liability to error. The measuring of gas is not an interrupted process, and no attendant is required. The machine performs the whole of the work, and keeps a record of its own doings. Although each of the four chambers of the meter is filled in succession, they are so contrived that the current of gas flows continuously—faster or slower, as may be required—and suffers no interruption until entirely shut off. The most vigilant observer would not be able to determine the precise moment when one chamber was full and another empty; and yet the successive filling and emptying of each chamber respectively is more perfect than in measures used for articles which are twenty thousand times more costly.

Think for a moment of the work the meter does, and what is the value of the material it measures, comparing it, bulk for bulk, with other commodities. Take beer as one example, and cognac brandy as another; 1000 cubic feet of the former costing upwards of 400*l.*, and the same quantity of the latter about 8000*l.* Neither of these articles is measured to the dealer, or consumer, with anything like the accuracy of gas, and yet the latter costs in some places only five or six shillings per 1000 cubic feet.

The meter is not absolutely perfect; that is not to be expected of any machine. It may be as perfect as care and skill can make it; and if certain specified conditions could be always complied with, it would remain so—subject, of course, to the wear and tear of materials. But the meter is often subjected to rough treatment. Fixed in some of the most out-of-the-way-places, where it is exposed to extremes of temperature, and every variety of weather, or where it is shaken by passing of carriages or shutting of doors, it is no wonder that its use should be attended by occasional inconveniences. For these the meter is not to be blamed. A sheltered situation, and an uniformly low temperature, are most favourable to the proper performance of its duties; and yet, either from ignorance or other causes, these conditions are constantly neglected. When fixed in a warm room, the water in a meter evaporates. The machine, under such circumstances, requires occasional adjustment, or it will err in its measurement, and at last come to a stand-still. But the error is always against the gas company, and in favour of the consumer. The accidental defects of the meter, and which are chiefly the result of negligence, do not operate injuriously against the buyer, who has therefore no cause for complaint.

Magnitude of the Gas Interest.

The number of proprietary gas-works in England and Wales is, say, 560, and in Scotland and Ireland, 170. There are about 45 others, of which 33 are believed to belong to private individuals, and the remainder to parochial or municipal bodies. These make a total, for the united kingdom, of 775 distinct establishments for the manufacture and sale of gas, and which are considered to represent a capital of 10,500,000*l.* The dividends may be quoted at all rates—from none at all to ten per cent.; the average being a little over five per cent. The quantity of gas produced annually, say, in 1848, may be taken as equal to about 9,000,000,000 (nine thousand millions!) of cubic feet; the coal required for that quantity being 1,125,000 tons. After allowing for waste and leakage,

the quantity of gas actually sold is about 7,200,000,000 (seven thousand two hundred millions!) of cubic feet. These quantities, and the terms in which they are expressed, are but imperfectly understood by persons not practically acquainted with the subject. It may help a little to illustrate the matter by mentioning, that a gas-holder capable of containing the quantity first quoted, would require to be two miles in diameter, and one hundred and three feet in height. The light produced by the last quoted quantity of gas, being that sold, is equal to 342,857,143 (three hundred and forty-two millions, eight hundred and fifty-seven thousand, one hundred and forty-three!) pounds, or 153,061 tons of mould candles of six to the pound, and which, at 8d. per pound, would cost 11,428,571*l.* Compared with sperm oil, the quantity of that article required to yield the same light, would be 33,133,640 gallons, costing, at 8s. per gallon, 13,253,456*l.* The average price realized by the gas companies for all the gas sold, including that supplied to street-lamps, is, I believe, less than 4s. 6d. per 1000 cubic feet. Taking it at that price, the sum charged for the same would be 1,620,000*l.*

The number of men occupied in the manufacture of gas averages about 6000; and more than double that number obtain by it, in various ways, constant employment, making a total of at least 20,000. This does not include, probably, an equal, if not greater number, engaged in mines and iron-works, and in numberless processes which have had their origin and are kept in motion by this branch of domestic manufacture.

Gas Companies and their Customers.

A complaint is frequently made that gas companies can dictate the terms on which they supply gas, as their customers are compelled to deal with them. This sounds very like a hardship; but it is not often felt to be one. Gas companies, like others, have had to learn their business. Some of them have served long terms of apprenticeship, without acquiring much useful knowledge. In this respect things are improving. The interests of the companies, and of their customers, are found to be so closely allied, that old maxims, and old practices, as impolitic as they were oppressive, are now being abandoned. Something can also be said on the other side. Let it be remembered that gas companies, unlike other traders, are fixed to their own particular localities. Ordinary traders, or manufacturers, are restricted only by their capital, abilities, or inclinations. If one locality does not suit them, they can remove to another; or if there be no market for their goods in the vicinity, they can seek one at a distance. The business of a gas company generally increases from year to year; but in many cases, it has been at so slow a rate, that the proprietors have received a return very inadequate to the risks and costs incurred. At last, there is full employment for the works. They cannot, however long remain at that point. Further investments, for their enlargement, become necessary; and the bit-by-bit process, up to full occupation, has again to be repeated. For these, as well as many other reasons, known in practice, but not necessary here to be described, a tolerably wide margin should be allowed to gas companies; their business being necessarily confined to certain geographical boundaries.

If, from the foregoing particulars, it can be gathered that the manufacture of gas is an expensive process, inasmuch that large and substantial buildings, and costly machinery, are required for its production—that manual labour* constitutes a large item of such production—that the mains employed for its distribution cost considerably more than the works—that the loss of gas, under the most skilful management, is very great, and that all the charges, both of production and of distribution, are greater in proportion on a small than a large quantity,—so far I have accomplished the purpose I had in view. Whatever may be the locality, or the quantity required, there are conditions which cannot be dispensed with—charges which will always be constant—losses which can never be prevented—expenses which exceed the most rigid views of economy, and the most liberal estimates of expenditure. The smaller the quantity required, the greater must be the price, other circumstances being equal; the greater the quantity required, the smaller the price, all other conditions being the same. The limit of minimum cost being reached, an increase of quantity will cause no further saving. On the contrary, the cost will be increased, because duplicate works would then be not only more convenient, but absolutely necessary.

Neglect of Private Lighting.

The advantages of gas-light in private houses are beginning to be understood. It is still only a small beginning, and, in numerous instances, it has not even come to that. In a few large towns, something in this way, deserving both of notice and of imitation, has for some time been in progress; but not

* The greater part of the labour in gas works is incessant, and it is often heavier at night than by day. Separate gangs of men are therefore required, and the wages paid are consequently for fourteen, instead of six, days per week.

a tenth part of what might be done, or of what must be done, has yet been accomplished. Gas companies must extend their operations. Low prices, and a small rate of profit, require large returns to pay satisfactory dividends. Here is a field so extensive that all may labour in it, and in which the ground is so well prepared that the results will be immediate, and in exact proportion to the energies put forth. The difficulties are but trifling, and many of them imaginary. By devoting constant and special attention to the lighting of private houses, a new business might be created. It will differ in many respects from old-established usages; and in none more than the greater number of burners required to produce an equal amount of revenue; but it will soon be found to possess the essentials of a good business—permanency and profit.

This is a matter on which I speak from experience, and therefore with the fullest confidence. In this department of gas-lighting, probably no one has worked more assiduously or had greater difficulties to contend with; and I believe no one has greater reason to be satisfied, or has realized a greater amount of success. The time was, that a single burner over the front door was the utmost that could be conceded. Now the same houses are well lighted throughout, the burners varying in number from five to twenty, and in some instances thirty in each house. As respects houses of a superior class, which have been recently erected within the sphere of my own labours, the use of gas in them is the rule—its absence the exception. The demand is steadily increasing. Tradesmen are lighting their houses from the cellar to the attic; lodging-houses are lighted, because they let the more readily; the mansions of the nobility are lighted, because gas is not only safer, and cleaner, and more convenient, but incomparably cheaper than candles or lamps. There are other persons, eminent for their talents and usefulness, occupying larger, and totally different spheres, amidst a manufacturing and a mercantile population, who bear their willing testimony to the rapid growth and beneficial results of private lighting. It must go on. Let gas companies perform their part well, and which consists in something more than thinking and talking; let there be a full supply of gas, of good quality, perfectly pure, and at a fair price, and there need be no fear but the public will do all that can be reasonably expected or required. Gas proprietors and directors, in their respective localities, should set an example to their neighbours, by lighting their own houses. Many have done this, and always with good effect. This is the best kind of persuasion. It is particularly needed in small towns; for no arguments are so convincing, no illustrations so conclusive, as those obtained by actual practice. It is, of course, a matter of taste and of choice whether gas be used or not; but it is no proof of wisdom to advise others to do that which is not approved of by oneself. Persons who have been largely interested in gas companies these twenty years, have never had a gas-light in their houses; and know no more about its properties or its management than they do of conducting a locomotive engine.

The period is not remote when the benefits of gas-light will be experienced far beyond the limits hitherto prescribed. It must be as available to the mechanic as to his employer; in the cottages of the hard-working classes, as in the saloons of the wealthy. Let us hope that more salubrious situations will be selected, and more rational principles observed, in the construction of houses for the masses of the people. Health, and comfort, and cleanliness, must precede all other efforts to improve their habits, and to elevate their characters. Fresh air and effective sewerage are as necessary for the body, as education and religious instruction are for the mind. Ventilation and drainage being provided, other improvements will directly follow; and of these, not the least important will be the supply of good gas, and of pure water.

The Electric Light.

Whether the electric light will ever be so complete, both in its mechanical and voltaic arrangements, as to be of any practical utility, or whether it will remain, as at present, a wonderful illustration of electrical agencies, and nothing further, are questions which must be left for futurity to answer. The man is more bold than wise, and proves himself no safe guide in such matters, who ventures to solve either of them now. That which appears impossible to-day, might, perhaps, be easily accomplished to-morrow. The annals of science, and of invention, are crowded with examples in which one happy thought, one simple condition, one little lever, or wheel, or pinion, has finished, and crowned with success, the labours (with its attendant losses and disappointments) of many years. But we must look also on the other side; and there are found discoveries, and inventions, and machines, without number, which, for want of a happy thought, a required condition, a lever, a wheel, or pinion, in the right place, still remain unfinished.

In the mechanism of the electric-light some improvements have been made. In other respects the progress is remarkably slow. Patent after patent has been granted; years of labour, and large sums of money have been expended; but, as respects real usefulness, nothing seems to have been accomplished. A light of dazzling brilliancy can be shown for a few minutes at a time. Sir Humphrey Davy did this; and hundreds of others, some for amusement, some for instruction, have done the same. Steadiness and continuity are qualities essential to all methods of artificial illumination. In each of these qualities the electric-light is deficient. If it be so cheap, that light equal to one hundred candles costs only one penny per hour, if it be so easily managed that it can be as readily adapted in lighting a private house as the most extensive building, and whether the light required be equal to 10 or 100, or 100,000 candles, might it not have been expected, that privately, or in public, at least one specimen of the light would have been kept in action for a few hours every night to have demonstrated its capabilities?

Those who understand the details of the process,* do not wonder that the electric light is intermitting and uncertain. To maintain, at a high intensity, an uniform power in a voltaic battery, is sufficiently difficult; to adjust the carbon points, even by the aid of the most ably-constructed machinery, is apparently impossible. Increase, or diminution, of power in the battery renders necessary a new adjustment of the carbon. Differences in the quality of the latter, or the admixture of impurities, also interfere with the success of the operations. Machinery, however sensitive, cannot adapt itself to these constantly varying conditions. It may be perfect in its motions, and exact in its graduations, but still it cannot *think* about its work, or *know* what it has to do; and hence, in this instance, it fails in performing all that is required. At one period of the process the carbon point may probably be required to move at the rate of $\frac{1}{100}$th of an inch in a certain time, at another the required rate may be $\frac{1}{1000}$th, or $\frac{1}{10000}$th of an inch in the same time. Herein consists some of the practical difficulties. These are only a small part of them.

As respects cost, nothing at present need be said. It will be time enough to discuss the economy of the process when all other objections, and especially those of manipulation, are cleared away. If electric power could be obtained without cost that would not aid the invention. The causes of failure are more recondite than the prices of acids and of metals. In the present state of our knowledge, and notwithstanding all the so-called recent improvements, the electric light remains, what it has hitherto been, a very impressive, and very brilliant philosophical experiment, and nothing more.

* The light is produced by a current of electricity, generated by a powerful voltaic battery, and which is transmitted through small cylinders of carbon (charcoal) extremely hard, and as pure as it can be obtained. The points of the carbon are not in contact. The light is formed in the space between them, and is caused by the interruption of the electrical current in passing from one piece of carbon to the other.

THE CASE IN EVAPORATION.—(SEE ANTE, P. 367.)

Sir,—The whole strength of the arguments of "F. B. O." seems to rest upon the supposition, that steam 9 lbs. pressure, 238° Fahr., would not be condensed (that is to say, reduced into its liquid state) at a temperature of 231°. Now *the temperature of steam whereat it is generated, and the temperature whereat it will commence condensation, are one and the same;*—or in other words—*no particle of heat can be abstracted from steam of any pressure and corresponding temperature, without causing actual condensation.* If, therefore, water of 237° is made to flow in sufficient quantity through pipes within the steam spaces of boiler No. 1 (pressure 9 lbs. per square inch) steam will be condensed on their surface as fast as it is generated by the fire below. To satisfy "F. B. O." on this point, I need only leave him at liberty to submit my communication to any test he thinks proper; but I even request him to lay it before persons of sound knowledge; for instance, ———, or ———, but I must deprecate the opinions of MERELY PRACTICAL engineers, who sometimes have no idea what steam is, although they may be able to construct a very efficient engine according to established rules.

I would also draw attention to the fact that *temperature* cannot be used *for a measure of heat*, it being only an indication of its *intensity*. The temperature of the fire below a boiler averages 1000° to 1500° Fahr.; but that of the water within the boiler is limited by the elastic pressure upon its surface, because all additional supply of heat is at once

rendered latent by the formation of steam. Heat applied superficially is certainly not lost, but will cause *slow evaporation*, although it cannot heat through the water or make it boil—water (unlike metal) being a very bad conductor. If fire is so supplied *below* the water, its temperature will become equal throughout. I am, Sir, yours, &c.,

G. D.

IMPORTANCE OF A SUPPLY OF AIR TO FURNACES.

[From "Wray's Practical Sugar Planter." 1848.]

The judicious hanging of the boilers or evaporating pans, is a subject of such great importance, that I must particularly direct the attention of the planter to this great means of economizing his fuel. A range of evaporators, badly hung, will frequently consume as much fuel as two ranges that are well hung, and yet not do so much or such good work as either of the latter. In Jamaica, the chimney flues are usually very much too small, of which fact many planters have of late years been convinced; consequently, many estates have not only had their coppers rehung, but their chimneys rebuilt.

In these cases, the improvement in their working and the economy of fuel has been so great, that the managers of the estates have expressed themselves quite delighted. In respect to machinery, well-hung boilers, and large chimneys, Demerara seems to have set the example—an example which, I understand, many of the islands are following. In hanging boilers (evaporators), a very great object is to secure the admission of a supply of air about the second tache or the third boiler, as by this means the combustion of the fuel is rendered complete, and little or no smoke is seen to issue from the chimney.

A wedge-like slit or opening in the wall accomplishes this end very desirably; *i. e.*, a slit in the wall (between the first and second tache), of about eight inches high, half an inch wide (next the flue), and opening outwards to fifteen inches wide.

In this opening a loose brick may be placed so as to regulate the admission of air. The first time I saw this plan in operation, was in the upper part of India, when visiting a native kerkhanna (refinery) on a large scale. The fire was large, and burning fiercely; but I saw no smoke coming from the very low chimney: so I inquired how it happened that the wood burned so brightly and well, and no smoke came from the chimney? When the native immediately pointed out to me two small openings (as I have described), which admitted air into the midst of the burning mass, and effected the complete combustion of the fuel without producing any smoke.

To test the effect of these air-holes, I had fresh wood added, which occasioned the smallest possible amount of smoke to issue from the chimney. I then stopped up the air-holes, when the smoke rose in dense volumes.

During some days that I remained in the neighbourhood, I tried the same experiment, and many others of a similar character, but always with the same result. I found, on inquiry, that it was an ancient custom, and much practised by the Nepaulese. I never saw it in India but three times; for the native kerkhannas very seldom have any chimneys to their furnaces; but what I did see was so entirely convincing, that I should never think of erecting (hanging) evaporators, or boilers of any description, without having them provided with similar inlets for a supply of air to air combustion.

THE BRITANNIA TUBULAR BRIDGE—FLOATING OF ONE OF THE TUBES.

We extracted recently (No. 1377, p. 279) from Professor Gordon's Notes to the English Edition of "Weisbach's Mechanics," a very full and interesting account of the preliminary experiments made by Messrs. Stephenson, Hodgkinson, and Fairbairn, to test the tubular principle of construction proposed to be adopted by Mr. Stephenson in carrying the Chester and Holyhead Railway (by two bridges) over the Conway and Menai Straits. We have now the pleasure of recording the accomplishment during the present week of the principal portion of the most difficult of these two undertakings—the Menai Bridge. The following particulars of the event are extracted from the report made by an intelligent eye-witness to the *Times* and *Chronicle* newspapers:—

As the construction and launching of these great tubes is one of the most extraordinary mechanical and engineering exploits of the day, and as the more scientific portion of the public have no very definite ideas respecting them, it may not be out of place, as the result of a visit to the spot, to give a few particulars in connection with these novel and gigantic works of art. The design of these tubular bridges had its origin from the peculiar difficulties to be encountered and overcome in carrying the Chester and Holyhead Railway over that great arm of the sea known as the Menai Straits. These, when taken in relation to the erection of the ordinary form of bridge, such as the suspension and the span, were found to be almost insuperable, owing to the difficulties of the site, the great extent of the stream, and the height at which either would have to span the intervening space, so as not to interfere with the vast navigation, vessels of large size and in

full sail continually trading up and down, and at the same time to establish adequate means of communication for the great mercantile transport between London and Dublin, and which is now delayed for upwards of an hour on account of the break that exists in the transit over the straits. Originally it was intended permanently to appropriate one side of Telford's celebrated suspension-bridge, which, with its light and beautiful tracery, spans the straits about a mile below the site of its more massive successor; but it soon became evident that so slight a fabric would not answer for heavy trains—that the line could never be considered complete, or commensurate with the requirements of the public, unless carried by a rigid instead of a flexible structure over the stream; and the idea, moreover, of using the suspension-bridge was altogether abandoned on an intimation from the Commissioners of Woods and Forests that they objected to the use of the suspension-bridge at all. Mr. Stephenson then proposed an arched bridge, about a mile to the south or Carnarvon side of Telford's suspension-bridge, on a site admirably adapted for the purpose, there being a huge rock in the centre of the Straits rising above high-water mark, with sufficient base for the most ponderous pier. It was determined, by the aid of this natural foundation, to throw over a huge iron bridge of two cast-iron arches, each of 450 feet span, or exactly 210 feet longer than the large arch of Southwark Bridge, familiar to every reader, and which, though only 240 feet, is the largest rigid span hitherto attempted. The height of both these arches was to be 100 feet at the crown, and the total cost would have been 250,000*l.* Ultimately this design was also abandoned, the Admiralty insisting on a height not merely of 100 feet at the crown of the arch, but also close to the piers, conceiving that the structure otherwise would interfere injuriously with the navigation. It was this that led to the grand and untried design of the present rigid wrought iron tubular bridge, which Mr. Robert Stephenson, after great thought and labour, assisted by Mr. Fairbairn, Mr. Hodgkinson, of the Royal Society, and Mr. Edwin Clark, the engineer of the works, gentlemen well known for their mathematical and scientific attainments, matured. The entire length of the stupendous structure is 1,841 feet from end to end, consisting of four large sections, the two side tubes being each of them 230 feet long, and the two middle ones 460 feet long each.

The word "tube," it may here be observed, is not one of the best epithets that could be used to describe the structure, seeing that the bridge, instead of being round, is a perfect square. Though a misnomer almost, the name arises from the circumstance of the experiments that were to decide the form of the bridge having been made with cylindrical, elliptical, and rectangular tubes, but in reality the structure, as it now rests on the banks of the Menai, the site of its construction, is an immense closed-in iron corridor, forming a horizontal iron gallery or passage, within which the rails for the trains are to be, and 450 feet in length. It is hollow from end to end, and would, if filled with shops, and lighted by skylights, resemble Burlington Arcade. A structure of this kind, though on a rude and miniature scale, appears to have existed for years on the Cambridge line of the Eastern Counties Railway, and Mr. Stephenson, the author of it, amplifying upon this, designed the present tube. A long series of fundamental experiments by the engineers and mechanics, fully conversant with such researches, were made, and have been continued to the present time, directed to the ascertaining, divested of all preconceived ideas, the strongest form for a sheet iron tubular bridge; and the inquiry, in addition to the more immediate object it had in view, has been of immense public service, in determining the strength of the materials used in the formation of railways. These experiments have been extremely laborious, and very costly. In the course of them the remarkable fact has been disclosed, that the power of wrought iron to resist compression is much less than its power to resist tension, or exactly the reverse of that which holds with cast iron; and the important fact has also been arrived at, that rigidity and strength are best obtained by throwing the greatest thickness of material on the upper side. While the cylindrical tube with a given weight was ruptured by tearing asunder at the bottom, the elliptical showed weakness at the top. Both were consequently discarded, and the rectangular tube, which indicated strengths of a higher order and greater rigidity, was adopted. The results of very recent experiments on this species of structure, on a small scale, over the Conway, are very interesting, as confirming the accuracy of the original calculations. Measured by a chord line in the inside of the tube, formed by the axis of a powerful telescope fixed to its side, the deflections have been, with a weight of 52 tons, 0·48 inch; 112 tons, 0·98; 173 tons, 1·30; 225 tons, 1·47; and on the removal of these loads the tube has recovered its rigidity in ten minutes. The tube is constructed to bear, in addition to its own weight, 2,000 tons, a load ten times greater than it will ever be called upon to sustain. The deflection caused by trains and locomotives passing at full speed is very slight. A weight of 300 tons has produced a deflection of three inches. A very remarkable phenomenon is connected with this huge mass of iron, of 1,600 tons, caused by changes of temperature in the weather, which affect it like a thermometer. A little sunshine raises the centre an inch, and produces a horizontal deflection of an inch and a half. Its great length and the nature of its material, so sensitive to temperature, in the peculiar form that it takes, causing it to expand ·0001 of its length, or half an inch for each 15° of Fahrenheit, and contracting in the same ratio, is the assigned cause of its being such a delicate thermometer. Alternate sunshine and showers of rain cause these tubes to expand and contract, and one of them, if placed on end in St. Paul's churchyard, would be 107 feet higher than the top of the cross. It is calculated that the wind at a velocity of 80 miles an hour, the rate of a hurricane, would only give a total pressure of 125 tons distributed over the whole side of these tubes.

The abutments, on either side of the straits, are huge piles of masonry. That on the Anglesey side is 143 feet high, and 173 long. The wing walls of both terminate in splendid pedestals, and on each are two collossal lions *couchants*, of Egyptian design, lifting their limestone foreheads in the face of every train. These lions, like the tube they adorn, are on a gigantic scale, each being 25 feet long, 12 feet high, though couched, 9 feet abaft the body, and each paw 2 feet 4 inches. Each weighs 30 tons. There is some intention of surmounting the central tower with a colossal figure of Britannia, 60 feet high.

The towers for supporting the tube are of a like magnitude with the entire work. The great Britannia Tower in the centre of the straits is 62 by 52 feet at its base; its total height from the bottom, 230 feet; it contains 148,625 cubic feet of limestone, and 144,625 of sandstone; it weighs 20,000 tons; and there are 387 tons of cast iron built into it in the shape of beams and girders. Its province is to sustain the four ends of the four long iron tubes which will span the straits from shore to shore. The total quantity of stone contained in the bridge is 1,500,000 cubic feet. The side towers stand at a clear distance of 460 feet from the great central tower; and again, the abutments stand at a distance from the side towers of 230 feet, giving the entire bridge a total length of 1,849 feet, corresponding with the date of this present year of grace. The side or land towers are each 62 feet by 52 feet at the base, and 190 feet high; they contain 210 tons of cast iron.

The scaffolding of the towers is very lofty, and the weight it has to support is 1,300 tons. The framing round the Britannia Tower rises to the vast

height of nearly 250 feet. The entire scaffolding is capable of sustaining 2,000 tons. There are in it 570,000 cubic feet of timber and 20 tons of iron bolts.

The chief centre of attraction was the inferior and exterior of the novel and gigantic tubes; the one floated on the pontoons, and the others, as they lay upon the platforms, presenting the appearance of stupendous iron tunnels. As these were the lions of the day, and as one of the largest was safely floated to its final resting-place, much interest will attach to its description, and a description of the one in question will be a description of them all. The length of the great tube is exactly 470 feet, being 12 feet longer than the clear span between the towers, and the greatest span as yet attempted. This additional length is intended to afford a temporary bearing of 6 feet at each end, after the tube is raised into its place, until there is time to form the connection between the tubes across the towers. Their greatest height is in the centre 30 feet, and diminishing towards the end to 23 feet. Each tube consists of sides, top, and bottom, all formed of long, narrow, wrought iron plates, varying in length from 12 feet downwards. The direction in which these plates are laid and riveted together is governed by the direction of the strains on the different parts of the tube. They are of the same manufacture as those for making boilers, varying in thickness from three-eighths to three-fourths of an inch. Some of them weigh nearly 7 cwt., and are among the largest it is possible to roll with any existing machinery. In the sides the plates are 6 and 8 feet long, and half-an-inch thick, but the longest plates are in the bottom, being 12 feet long, by 2 feet 4 inches wide, and are in double layers. At the top they are 6 feet in length and 1 foot 9 inches in breadth. The connexion between top, bottom, and sides, is made much more substantial by triangular pieces of thick plate, riveted in across the corners, to enable the tube to resist the cross or twisting strain to which it will be exposed from the heavy and long-continued gales of wind that, sweeping up the Channel, will assail it in its lofty and unprotected position. The rivets, of which there are 2,000,000, each tube containing 327,000, are more than an inch in diameter. They are placed in rows, and were put in the holes red hot, and beaten with heavy hammers. In cooling, they contracted strongly, and drew the plates together so powerfully that it required a force of from four to six tons to each rivet to cause the plate to slide over each other. The total weight of wrought iron in the tube floated yesterday is 1,600 tons. It has been constructed by Messrs. Garforth, of Dunkinfield, Manchester, and the others by Mr. C. Mare, of Blackwall. The trains will pass through them over the straits at 100 feet above high water. The names of the gentlemen who have been continuously engaged on this great work since 1847 are, Captain Moorsom, the resident director; Mr. Frank Forster, resident engineer; Messrs. E. and L. Clark, and Wild, assistant engineers; Messrs. Nowell, Hemingway, and Pearson, contractors for the masonry; Messrs. Mare, of Blackwall, and Messrs. Garforth, of Dunkinfield, contractors for the iron tubes; Mr. J. Greaves, general manager of the masonry; Messrs. J. and A. Greaves, contractors for the scaffolding and stages; Mr. G. Campbell, engineer of the tube work, and Messrs. J. Morris and H. Hodgkinson, managers of it, all of whom were present.

Such were the dimensions of the monstrous fabric, the arrangements for raising which were in every point complete. At 3 o'clock on Tuesday, the 19th, the spectators by tens of thousands had taken their places upon the piers, the tubes and shores on either side, and the Straits for a mile in length presented a vast amphitheatre of human beings. The pilots, to the extent of 200 or 300, took their stand on the pontoons to ply the gigantic tackle; as many more stood ready for action at the capstans; the cables, six inches in thickness, and of a league long, were attached to the steamers that were to have the towing of the tremendous freight. Multitudes of yachts, small boats, and other craft, filled and gaily decorated, passed up and down the stream, and all eyes were fixed with mingled feelings of confidence and fear on the gigantic fabric, upon which stood Mr. Stephenson and Captain Claxton. Soon after, the utmost excitement ensued, on the first signal, that of the sudden springing up on the Anglesey side of the first signal flag, and a shrill strain from the trumpet of Captain Claxton from the top of the tube to the pilots, to take the tide, and pipe all hands for the exploit. This was responded to by a loud burst of enthusiasm from the seamen, whose efforts, united to those of the steam tugs, told upon the screws and tackles, and upon the hitherto motionless monster, which then glided very slowly, and amid intervals of unceasing cheers and salutations, without injury or jar, to its final resting place.

During the operation, however, one of the capstans broke; from no insufficiency of strength in the capstan itself, but from the fact of the shore lashings behind the tube not having been cut away or detached from the tube, and, as a natural consequence, while the capstan was employed in drawing the tube out into the stream, the shore lashings detained it, and the capstan, failing to overcome the resistance, started, strained, and broke.

[The operations were resumed on the evening of the following day (Wednesday) and the following is the report of the result.]

Menai Straits, Thursday.—The unparalleled exploit of depositing the tube in its bed of masonry, at the base of the piers, has been at length accomplished. The tube was floated obliquely, then gradually swung round, with its face to the space between the piers. Arrived here, the next step was one of the most vital and absorbing nature, seeing that if, from anything in the run of the tide, which was progressing at the rate of three miles an hour, or any giving way in the great net work of tackle, the tube overstepped its line of destination parallel with the piers, the experiment must have failed, and the process of bringing it back would have been of great practical difficulty. Fortunately, however, such were the nicety of the arrangements, that the success of the final step was unerringly secured. The next operation, that of elevating the tube to its permanent position, will be accomplished as soon as possible. This is to be done by hydraulic power.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 21ST OF JUNE.

JOSEPH ECCLES, Moorgate Fold Mill, Blackburn, Lancaster, cotton spinner, and JAMES BRADSHAW and WILLIAM BRADSHAW, of the same place, watchmakers. *For certain improvements in and applicable to looms for weaving various descriptions of plain and ornamental fabrics.* Patent dated December 15, 1848.

Claims.—1. Causing the reed to vibrate upon slay swords or their substitutes, independently of, and without connection or attachment to the shuttle boxes, and the reed to proceed to and recede from the operation of beating up without the shuttle boxes.

2. An arrangement of cams and levers for imparting a variable motion to the reed during a portion of the beating up operation, so as to cause it to "dwell" while the pick is being

performed, and to travel at increased velocities in proceeding to and from the operation of beating up the weft.

3. The application of metal pickers to power looms, certain mechanical arrangements for working the picking motion, and an apparatus for carrying the pickers to the fly spindles.

4. An arrangement for effecting the change of the drop boxes in conjunction with the tappet wheels, so as to produce varieties of style and pattern in the fabric.

5. Certain arrangements for working the shuttle and drop boxes, independently of the vibrations of the reed.

6. Certain improvements relating to the taking-up motion.

7. Supporting the cloth on spiral springs.

8. The employment of a double-flanged pulley, with endless band and weights, to regulate the delivery of the yarn.

9. An arrangement for enabling the workman to adjust the cloth by dial and index.

10. Causing the front plate of the shuttle to swivel on a pivot or spring.

11. A mode of stopping the loom when the shuttle misses boxing, or the supply of weft ceases.

12. A mode of applying friction breaks to the periphery of the fly-wheel simultaneously with the stoppage of the loom, and also of regulating the leverage of the breaks.

13. A mode of working any requisite number of headdles in twill or plain weaving, so as to produce varieties of pattern.

14. A mode of making any number of picks in the shed, in combination with the variable heald motion.

Edward Smith, of Kentish Town, window-blind manufacturer. *For improvements in window blinds, and in springs applicable to window blinds, doors, and other like purposes.* Patent dated December 16, 1848.

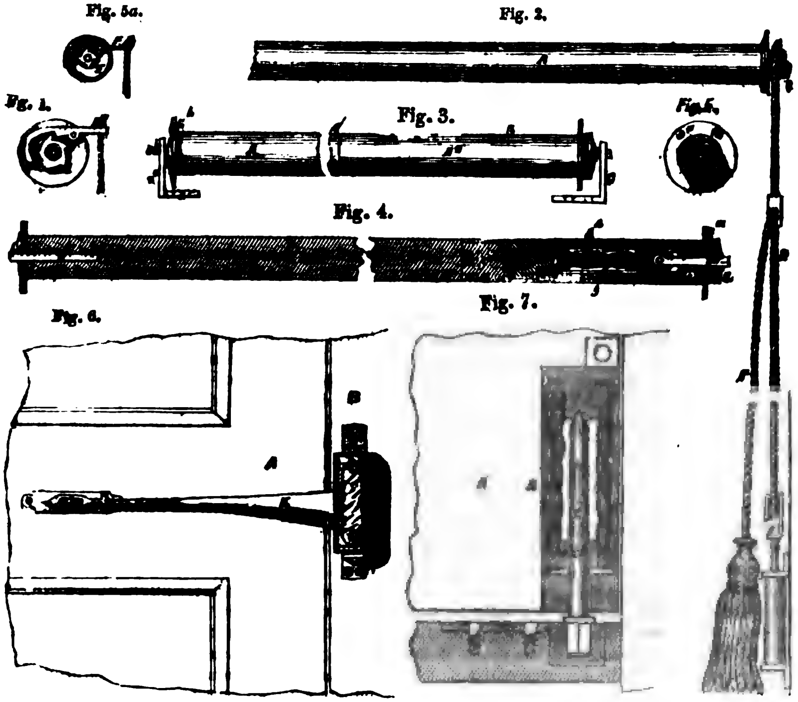
Mr. Smith's invention, in so far as it regards "window blinds" has reference to what are called "roller blinds," and consists in certain improved modes or means of raising and lowering such blinds, however such blinds may be constructed in other respects; and his improvements in springs "applicable to window blinds, doors, and other like purposes," consist in the application thereto of a description of springs (commonly called torsion springs) never hitherto used for this purpose, though possessing (probably) greater power than springs of any other sort, to effect the quick raising or lowering of blinds, or the quick opening or shutting of doors, or the quick change of position of any other matters or things similar in their construction and uses—such, for example, as curtains, screens, roller maps and plans.

The improved modes or means of raising or lowering roller window blinds are two in number. The *first* consists in dispensing with the spring ordinarily used to press the paul on the ratchet wheel, which controls the action of the roller. This is effected by weighting the short or inner end of the paul, as shewn in fig. 1, so that when it is desired to cause the paul to catch into the teeth of the ratchet, it is only necessary to relieve it of part of the weight of the cord and tassel by holding it up by the hand. The operation is thus perfectly noiseless. The *second* improvement under this head of the patent consists in a more convenient method of pulling the endless cords by which the blinds are raised and lowered. The details of this method are exhibited in fig. 2. A is the roller; B, an internal toothed grooved pulley affixed to one end of the roller; C is the bracket; D, an endless wire, or other cord, which takes into the grooved pulley at top, and at bottom runs upon a spring or common rack pulley, E. F is a tasseled cord which is affixed to the buckle joining the ends of the cord. The advantages gained by this arrangement are, that a much smaller pulley can be used on the end of the roller, and the hand, in pulling up the blind, has therefore to move through a much less space than is the case where a large pulley is employed. The tasseled cord besides is much more convenient to lay hold of than when the endless cord alone is employed.

With respect to the torsion springs which constitute the other branch of Mr. Smith's invention, he desires it may be understood that he prefers in all cases making these torsion springs of vulcanised India rubber, as being a more permanently elastic material than any other with which he is acquainted, and much less liable to get out of order; but that they may be made also of strips of metal, or of metal wire, or of whalebone, or of catgut, and of various other substances more or less elastic or pliable; and that he does not, therefore, restrict himself to the employment of any particular substance in the construction of the said springs.

Figs. 3, 4, and 5, of the annexed engravings show how such torsion springs may be applied to a window roller blind.

Fig. 3 is an external elevation of the roller; fig. 4, a longitudinal section of fig. 3; and fig. 5, a cross-section on the line *ab*, of figs. 3 and 4. A is the roller, which is composed of two parts, A^1 and A^2. A^1 is a solid cylinder of wood (or it may be of any other suitable material), and A^2 a metal tube which is affixed to one end of A^1, which is recessed at that end for its reception, so that both parts of the roller may



be externally in one straight line. C is a wooden plug with metal cap, C^a, which is inserted into the outer end of the tubular part, A^2. D is a ratchet wheel which is affixed to the outside of the cap, C^a. E, a box which contains the spring and short-arm of the paul or click, F, (fig. 5^a,) and is fitted upon the ratchet wheel by means of a fixed spindle, D^a, which passes through the centre of the ratchet wheel, and also through the cap, C^a, and plug, C, and extends a little way beyond the latter into the interior of the tube, A^2. The spindle, D^a, projects at its outer extremity through the box, E, and terminates in a square piece, which fits into a corresponding aperture in the bearing bracket, G^1, (neither the box nor spindle being intended in any case to revolve). C^b is a cap which is attached to the outer end of the part, A^1, of the roller, and has a short round spindle, D^b, which takes into a circular hole in the bracket, G^2. The axes, therefore, upon which the roller revolves are the spindle, D^a, at one end (when the ratchet wheel is released from the paul), and the spindle, D^b, at the other; only that in the former case the roller turns round the axis, while in the latter the roller and axis revolve together. H is the torsion spring which consists of a thick strip of vulcanised India rubber inclosed within the tubular piece, A^2. At one end, this spring is made fast to a block, or plug, inserted into the inner end of the tube, and at the other end to the fixed spindle, D^a, of the click-box, E. When the roller is pulled round, and the blind drawn down (an operation to which the click, F, offers no resistance), the revolution of the roller causes necessarily a twisting or torsion of the strip of vulcanised India rubber, because one end only (the inner end) revolves with the roller, while the other (that attached to the spindle, D^a,) is fixed. The moment, however, the click, F, is released, the powerful tendency which the torsion spring has to return to its original position comes into full play, and causes the roller to revolve in the contrary direction, and thereby raises the blind.

In fig. 6 is shown how the torsion spring may be applied to doors. A is part of the door; B, the door post; C, the spring-box, or tube, containing the piece of vulcanised India rubber, partially twisted to give it greater power. The India rubber is affixed at bottom to the end of the tube, with which it revolves, and at top to the fixed spindle, D, by which it is held stationary. E is an arm which projects from the spring-box, and presses against the door. When the door is opened, the arm E, causes the spring-box to be turned

round, and the India rubber inside of it to receive a still further twist. The India rubber occupies the place and fulfils all the duties of the coiled steel spring generally employed in back springs for doors.

Fig. 7 exemplifies the application of a torsion spring to a double-acting spring, that is, to a spring for closing a door, either outwards or inwards. A is the door; B, the spring-box (partly in section); C, a pin which is stepped in the plate, D, which is affixed to the floor. E is a bearing which rests upon the top of the pin, C, and upon which it reposes as a centre, on which the door may turn; this bearing forms the upper end of the spring-box. F is a collar which is affixed to the pin, C, and, like it, cannot turn round. G G are two thick strips of vulcanised India rubber, which are securely attached to the bearing, E, at top, and to the collar, F, at bottom. When the door is either pushed outwards or inwards, the India rubber springs are thereby twisted, more or less, each on its own axis, and the moment the door is relieved from pressure the natural tendency of the springs to resume their normal position, causes the door to close. To increase the power of the springs, they may be partially twisted previously to being fixed in their places, the one to the right hand and the other to the left, as represented in the engraving.

From the preceding exemplifications, it will be readily seen how torsion springs may be applied to all purposes like to the raising or lowering of blinds, or opening or shutting of doors; no other modifications being in any case necessary than such as any competent workman will be able to supply.

Claims.—1. I claim the employment in roller window blinds of pauls weighted at one end, whereby the springs ordinarily used are dispensed with, as before described.

2. I claim the employment in roller window blinds of a supplementary end cord, attached to the usual endless cord, for the purpose of more conveniently raising and lowering the same.

3. I claim the application of torsion springs to window blinds and doors, as before exemplified, and to all other like purposes.

John Cartwright, Sheffield, Yorkshire, tool-maker. *For an improved brace for the use of carpenters and others.* Patent dated December 16, 1848.

This "improved brace" consists of the skeletons of the top and bottom cranks, which are united together by a moveable and separate stem or spindle. The exterior of the cranks and the stem are covered with horn or gutta percha, moulded on; and the head, which is also of horn, is screwed upon a stem which is free to revolve in the top crank. The spring catch which is fitted into the interior of the bottom part, and serves to retain the bit in position, is made to take out of the bit by the lateral movement of the nozzle, and so to allow of the bit being withdrawn, and another substituted in its stead when required.

Claims.—1. Casting the skeletons of the crank portions of the braces in metal, and connecting them by a stem, or spindle, for receiving a separate and moveable handle.

2. The mode of constructing and applying the heads.

3. The application of horn in the manufacture of the heads of braces.

4. Making the casings or coverings of the skeleton cranks of horn or gutta percha.

5. The mode of acting upon the spring catch by the lateral movement of the nozzle.

6. Making the handle of horn or gutta percha on a spindle.

William Major, Calchett, Leigh, Lancaster. *For improvements in looms for weaving certain descriptions of cloth.* Patent dated December 16, 1848.

The particular description of weaving to which this patent has reference is that in which two pieces of cloth are united at the selvages, and stitched together afterwards at any desired portion; and the improvement consists in an arrangement of apparatus whereby when the reed is driven home in the top warp, the weft of that part is tightened, and the weft of the lower warp slackened, so that the full force of the shock may be received by the weft of the upper warp, and *vice versâ*. For this purpose the two warps are led from the warp beam on either side of a roller, to prevent them coming into contact with one another, and then over two rollers, placed one above the other, and supported in bearings in the top and bottom ends of a lever, which vibrates on a pin fixed in the framework of the loom. The central shaft which gives motion to the batten, communicates also, through the intervention of toothed gearing and a system of jointed rods with the vibrating lever, whereby at each beat up of the sley, the top or bottom weft is alternately slackened and tightened.

John Clinton, Greek-street, Soho-square, professor of music, *for improvements in flutes.* Patent dated December 16, 1848.

Claims.—1. The giving motion to a distant key by means of a connecting rod, carried along the edges of some of the finger holes, so that, when any of these holes is closed by the finger the rod will be depressed, and the key to which it is connected acted upon.

2. The arrangement of some parts of

the mechanism of a flute, so that the C sharp and B natural may be closed simultaneously, and the C natural allowed to remain open, or opened at the same time.

William Clay, Clifton-lodge, Cumberland, Engineer, *for certain improvements in machinery for rolling iron or other metals; parts of which improvements are applicable to other machinery in which cylinders or rollers are used.* Patent dated December 16, 1848.

This invention has for its object to roll bars of iron or other metal, into a tapering form of a wedge-like, or conical shape, and is caused by allowing the distance between the compression rollers to increase gradually and progressively as the rolling goes on.

1. The arrangement for carrying this invention into effect, consists in making the bearings of the top compression roller moveable instead of stationary, so that they may slide up and down in their standards. Upon the top of this moveable roller bears the lower end of a vertical rod, furnished with a piston at the upper end, which passes through a water and air-tight stuffing-box, into the bottom of a cylinder. This cylinder is filled with water or other non-elastic liquid, and is provided on either side with inflow and outflow valves. The rate of outflow of water from the cylinder is capable of being regulated to the greatest nicety by means of a screwed spindle, to the end of which the outflow valve is attached, so that as the liquid runs away, the piston, yielding to the pressure of the bar passing between the compressing rollers, will gradually and progressively rise up in the cylinder, and, consequently, allow the top roller to slide upwards in its bearings, whereby the distance between the two rollers will be gradually and progressively increased, and the desired taper given to the bar, the shape of which will depend upon that of the grooves. The top of the cylinder is provided with a safety valve loaded (by means of a spring) to a certain extent, so that in case the pressure should increase beyond it, the valve may open and allow the water to escape, and the piston to rise up to the top. The water is supplied from any convenient source, and the outflow valve is kept closed, when the machine is not at work, by a coiled spring placed behind it] upon the spindle. It is proposed to apply the safety-valve arrangement to sugar-cane crushing, and other mills, in order to obviate the injurious effects of sudden shocks.

2. A modification of the preceding consists in substituting for the hydraulic apparatus, a sliding frame which rests on the top of the vertical piston rod. Above this frame works an eccentric, or heart-shaped cam, keyed upon a shaft, so that as it revolves, the sliding frame will slide upwards, and allow of the top compressing roller doing the same. Rotary motion is communicated to the cam shaft from the bottom roller through the intervention of toothed gearing.

When it is desired to roll one portion of a bar tapering, and the remainder parallel, the piston rod is made to pass through a screw, capable of being adjusted to any convenient distance from the top of the upper compressing roller, and which catches against it, and thereby prevents its further upward motion.

Claims.—1. The application to rolling machinery in general, (when such is required) of apparatus by which the bearings of one of the compression rollers are allowed to rise gradually in their standards to allow of taper forms being produced with the same facility as parallel bars.

2. The construction or arrangement and adaptation of the hydraulic apparatus and its appendages, to machines for rolling iron and other metals, by which the shaping rollers are separated, so as to produce taper rod or bars by the rolling process.

3. The modification of the preceding, which consists in the employment of the eccentric or heart-shaped cam to regulate the gradual progressive separation of the rollers for the before stated purpose.

4. The adjustable screw in combination with the apparatus claimed under the second and third heads for rolling bars, tapering for a portion of their length, and parallel for the remaining part thereof.

Henry Walker, Gresham-street, London, needle manufacturer. *For certain improvements in the process or processes of manufacturing needles.* Patent dated December 16, 1848.

These improvements refer—

1. To the manufacture of crochet and tambour needles; and,

2. To the dry grinding or pointing of needles generally.

1. The patentee remarks, that crochet and tambour needles have hitherto been manufactured by filing, and that they are consequently dissimilar in size and shape. The object of the present invention is to obviate this disadvantage; and consists in reducing the wire to the required size by means of drawplates and a drawing-bench, such as goldsmiths use, and cutting it into proper lengths. The ends of the wires where the hooks are to be formed are pointed, and the stems wholly or partially flattened. The hooks are then stamped out by suitably formed dies, and the superfluous metal re-

moved by filing or by clipping machines, similar in principle and mode of action, although different in shape, to the ordinary needle-clipping machine. In order to hold the stem securely in the handle, the end is held in a notch in a spring clamp which is fixed fast in a vice. The end is then upset, and rounded by being afterwards subjected to the action of a punch and die in a stamping press.

2. In order to prevent the process of dry-grinding or pointing being injurious to the workman, it is proposed to shield the grinders with a blanket or other fibrous substance, instead of tin, which is kept constantly wet by a regular supply of water. The dust which is impelled against the shield will be condensed by its moist surface, and carried by the flow of water into a suitable receptacle. When the fibres of the shield become choked with the particles of dust, it is removed and freed from them by rinsing.

Claims.—1. The mode of reducing the size of the wire employed in the manufacture of crochet needles.

2. The flattening of the needles.

3. The use of tools of the various forms described in the specification, and represented in the drawings.

4. The application to the dry-grinding or pointing apparatus of a blanket kept constantly saturated with water.

William Wharton, Superintendent of the Carriage Department of the London and North Western Railway Station, Euston-square. *For certain improvements in the construction of vehicles used on railways, or on other roads and ways.* Patent dated December 16, 1848.

These improvements refer to wheels exclusively, and consist of the following modes of construction:—

1. The ends of a number of curved pieces of metal are cast into and around the nave, and metal wedges are inserted into the top and bottom spaces between the hoops. These wedges are held tightly together by screw bolts passing through them and the wooden felloe. These screw bolts, which allow of the parts being tightened as required, have the effect of pressing the ends of the hoops against the inside of the felloe, whereby a solid and compact wheel is produced.

2. Hexagonal wedges of wood are to be placed between the ends of the hoops which take into the nave, and the other parts of the wheel are constructed and arranged as in the preceding case.

3. It is proposed to substitute for the hoops, discs of wood with metal wedges between their top and bottom spaces, as in the first instance. These wedges are held together by screw bolts, which pass into the nave and attach them thereto. A split ring is bolted to the outside of the discs, and the tyre put on.

Claims.—1. The use and application of wedges, or wedge-shaped pieces of metal, in combination with, and adapted to bended or curved spokes of metal.

2. The application of wedges, or wedge-shaped pieces of metal, in combination with blocks of wood, either of the form described or of an hexagonal one.

Alfred Vincent Newton, Chancery-lane. *For improvements in casting printing types, and other similar raised surfaces, and also in casting quadrats and spaces.* (Being a communication from abroad.) Patent dated December 16, 1848.

These improvements relate, 1, to the regulation of the supply of molten metal to the moulds; and, 2, to the working of the matrices.

1. The melting pot is fitted with a central vertical tube, communicating with a horizontal one, which opens into a second vertical tube. The central tube is provided with a hollow piston or plunger, fitted on the inside with a valve, which, as it is drawn upwards, allows the metal to flow through the first vertical hole into the horizontal one, whence it is expelled by the down stroke of the piston up the second vertical tube, through a nipple adapted to the top of it, which is capable of adjustment.

The valves of the mould are supported just above the nipple in a pair of jaws, one of which is moveable, and worked by an adjustable tension rod. When the metal is expelled, the mould is brought close to the nipple to receive it, after which it is tilted up, withdrawn from the casting, and the latter pushed out of the way by an arrangement of levers and combination of mechanism, which would scarcely be intelligible without drawings.

Claims.—1. Regulating the supply of molten metal to the moulds, or matrices, by means of the piston or plunger.

2. The general arrangement of the melting pot.

3. The jaws, one of which is adjustable and moveable.

4. The adjustable tension rod.

5. The levers for tilting up the mould or matrix, and withdrawing it from the castings, and for pushing them out of reach during the rising of the arms and opening of the jaws.

John Penn, of Greenwich, Kent, engineer. *For certain improvements in steam engines.* Patent dated December 21, 1848.

Mr. Penn's improvements in steam engines are as follows:—

1. He places a floater in the condenser, or in a separate vessel suitably connected therewith, which, as the water accumulates in it from accidental or other causes, ascends proportionately. This floater is connected to a stop-valve placed in the injection passage. The result of this arrangement is, that as the water accumulates in the condenser, and the floater consequently ascends, the stop-valve will be partially or wholly closed, and the influx of the injection water regulated accordingly, whereby the passage of water to the steam cylinders will be prevented.

2. It is proposed to place in the steam passage leading from the boiler to the cylinders a suspended balanced vessel, which is connected to a stop-valve placed a little further on in the same passage, in order that, as the boiler primes or the water boils over, a portion may be received into this vessel, which will descend by its increased gravity, and act upon the stop-valve, so as to partially or wholly close the passage of the steam to the cylinders, whereby the engines will be made to work at a slower rate, and any injurious effects from sudden shocks to them be prevented.

3. A chamber, opened laterally to the water, is placed in the side of an auxiliary steam vessel beneath the water-line, and is fitted with a small submerged horizontal paddle-wheel, which is keyed upon a vertical rod carrying a bevel wheel at top. This bevel wheel gears into another bevel wheel keyed upon the end of a horizontal cranked rod, fitted with a connecting rod, which works a double pair of weighted bellows, similar to those employed by blacksmiths. The top of these bellows is connected by a combination of cams, jointed rods, and levers, to the expansion valves, or throttle valves, or dampers, so that as the speed of the vessel through the water increases, the velocity of the revolutions of the small paddle-wheel will increase also, and a greater quantity of air be driven into the top part of the bellows, which will consequently rise, and have the effect of regulating the passage of the steam to the cylinders, or the draught through the furnace. The bellows are provided with valves for regulating the quantity of air contained therein.

Claims.—1. The application in marine steam engines of a floater to the condenser, or separate vessel suitably connected thereto, and also of a stop-valve to the condenser or injection pipe; the two being so connected together that, as the water accumulates in the condenser, from accidental or other causes, the flow of the injection water thereto will be partially or wholly stayed until the air-pumps shall have reduced the water to its proper and determinate level.

2. The application in marine steam engines of a suspended balanced vessel to the steam passage leading from the boiler to the steam cylinders, and also of a stop-valve a little further on in the same passage; the two being so connected together that, as the priming or boiling over takes place, the passage of steam to the cylinders shall be partially or wholly closed, and the speed of the engine reduced accordingly.

3. The application of the self-acting mechanical apparatus to sailing vessels propelled by auxiliary steam power, through the medium of screws or other suitable propellers, and which apparatus is made to work inversely to the speed of the vessel—that is to say, that as the speed of the vessel increases from the sailing power, the steam power shall be reduced accordingly, or *vice versâ*, by means of this apparatus acting upon the expansion valves or throttle valves of the induction passages or the dampers of the furnace.

JOSEPH DEELEY, of Newport, Monmouth, engineer and iron-founder. *For improvements in ovens and furnaces.* Patent dated December 16, 1848.

(For specification see *ante* p. 578.)

Specification Due, but not Enrolled.

WILLIAM WEILD, Salford, Lancaster, moulder. *For certain improvements in rotary steam engines.* Patent dated December 16, 1848.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
June 14	1923	Southgate and Alcock,	Watling-street	Portmanteau.
„	1924	James Hardcastle	Firwood, near Bolton-le-Moors..	Calender for finishing muslins and other goods.
15	1925	Barnabus Urry	Newport, Isle of Wight	Horse-rake.
„	1926	Robinson and Russell,	Westmoreland-street, Dublin	Arrangement of serpentine passages and valves for cornopeans, &c.
18	1927	Edmund Spiller	Holborn-hill	Bachelor's kettle.
19	1929	William Robinson	Leeds	Mangling and wringing machine.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Henry Mills Stowe, of Bermuda, master of the brig *James*, for improvements in blocks and sheaves. June 20; six months.

Alexander Francis Campbell, of Great Plumstead, Norfolk, for improvements in wheels, ploughs, and harrows, steam boilers and machinery for propelling vessels. June 20; six months.

William Combauld Jacob, of Bread-street, London, warehouseman, for improvements in the manufacture of parasols and umbrellas. June 20; two months.

Richard Archibald Brooman, of the firm of Messrs. J. C. Robertson and Co., of Fleet-street, London, patent agent, for improvements in apparatus for transferring liquids from one vessel to another, and for filling bottles and other vessels with liquids. (Being a communication.) June 20; six months.

Charles James Coverly Griffin, of Southwark, hatter, for certain improvements in military accoutrements. June 20; six months.

Edward Lyon Berthon, clerk, bachelor of arts, of Fareham, Southampton, for an instrument to show the velocity of a ship or other vessel propelled through the water by wind, steam, or other moving power. June 20; six months.

Samuel Colt, of Trafalgar-square, Middlesex, gentleman, for improvements in fire-arms. June 20; six months.

NOTICES TO CORRESPONDENTS.

A stamped edition of the Mechanics' Magazine, to go by post, price 4d., is published every Friday, at 4 o'clock, p.m., precisely, and contains the Claims of all the Specifications Enrolled, all the New Patents sealed, and all the Articles of Utility registered during each week. Subscriptions to be paid in advance. Per annum 17s. 4d., half-yearly 8s. 8d., quarterly 4s. 4d.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the city of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

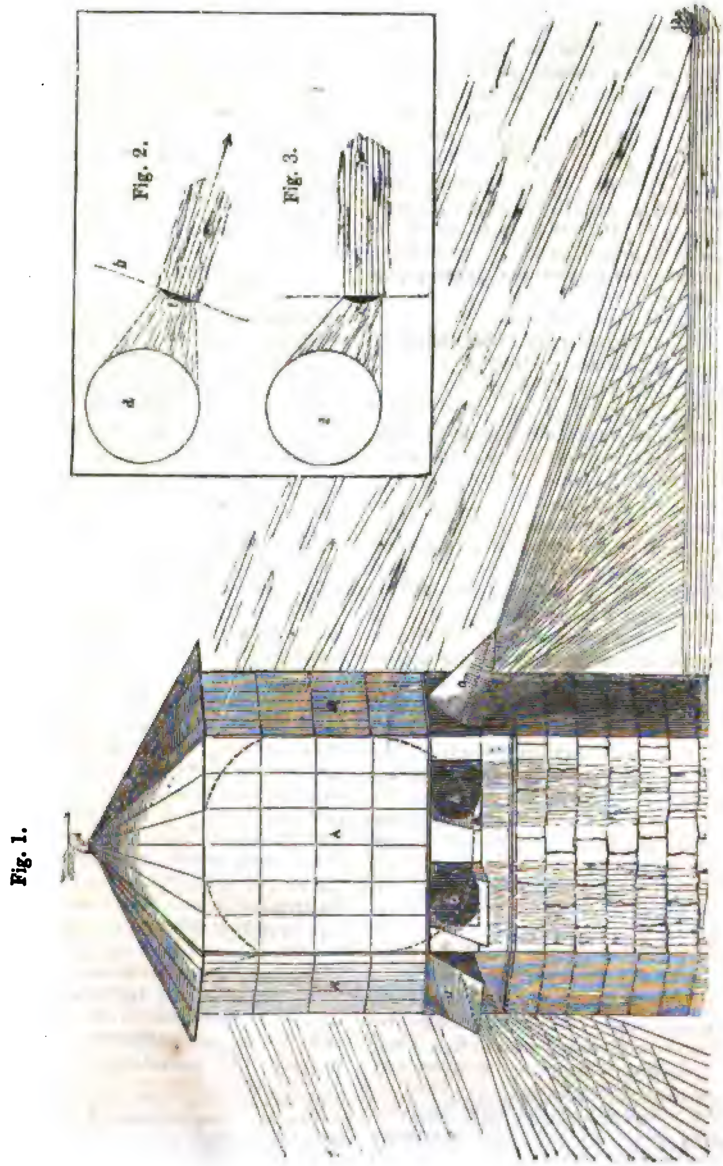
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1351.] SATURDAY, JUNE 30, 1849. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

MR. ASTON'S PLAN FOR ADDING DISTINGUISHING OR PROOF LIGHTS TO OUR PRESENT LIGHTHOUSES.



PLAN FOR ADDING DISTINGUISHING OR PROOF LIGHTS TO OUR PRESENT LIGHTHOUSES.

BY T. ASTON, ESQ., OF THE MADRAS LIGHT CAVALRY.

It must be obvious to every one how necessary it is that some improvement should be made in our present lighthouses, to distinguish them one from another with *certainty*. The mariner must continually be liable to mistake one light for another, more or less according as his reckoning may be more or less correct, or his acquaintance with the coast more or less perfect. Instance the *Great Britain* and the *Stephen Whitney*—the latter with 900 lives, both off the coast of Ireland. In thick weather, when every light cannot be seen, and tide, current, and wind drive a ship farther than, or in a different direction to where he expected, in such cases even a pilot would be likely to err as lighthouses now are.

In adopting "distinguishing" or proof lights, it is desirable, in order to avoid expense, to interfere as little as possible with the solid work of lighthouses. It is, therefore, proposed to cover with shelving boards or sheets of metal, a portion of the lower part of the window (say two or three feet) and in that boarding or metal sheeting to place a round or square piece of coloured glass, set with due regard to the lamp and reflector, both as to place and angle. If there be an objection to lessening the size of the window, it will be necessary to raise the roof, which appears to be preferable to interfering with the building *below* the window or lantern.

Fig. 1 of the prefixed sketches represents an elevation of the upper part of a lighthouse with my proposed addition.

A A A, is the lamp and reflector; *aa* are the shelving boards or sheets of metal, so fixed and regulated as to allow the coloured light beneath to be seen *to any desired distance*.

bb, coloured glasses, either square or round, and of any size, let into the frame of the window, *under a*.

If coloured lenses would throw their rays with as great exactness, and to as great a distance as the shelving boards or sheets of metal, then might lenses be used, as respectively shown in figs. 2 and 3, in which *cc* represents the lenses and *dd* the lamp and reflector.

The proposed "Distinguishing or Proof Lights" are supposed to receive their light from the main lamp and reflector, and therefore they would cause no extra expense to a lighthouse when once made.

If necessary, a distinguishing light may be intermitting;* and there might be more than one light in each face of the building, and this would vary the distinguishing lights. The light or lights in one face of a lighthouse might be shut out from those in the other by means of a partition board. When the distinguishing light of one face of the lighthouse opened it would give a particular "bearing;" and so the shutting out of any particular light would give some other bearing.

The carrying out of this plan in various ways is merely a matter of mechanical contrivance and skill, as these "distinguishing or proof lights" are only intended for short distances (say from half a mile to three or four miles), *two* lights might, if necessary, be placed, and without any fear of deceiving by appearing only as one.

It may be said that in thick and boisterous weather these distinguishing lights would not be seen at the full distance for which the light had been regulated; very good, but this objection holds good with any and every light. Objections if not to be overcome, must be modified or counteracted as much as possible.

The distance at which the lighthouse is wished to be seen should be regulated more for winter nights than summer ones; or the distance might be measured in clear weather, and then measured distances made of the light at different degrees of density of fog—say, for example 30° of density. This, to be sure, would require a little judgment on the part of the mariner, but he could not be *very* much out. However, a coloured light would at all times be seen in proportion to the main plain one.

It must be perfectly understood that these distinguishing lights are intended merely as *additions* to the main plain one—to be seen sufficiently far to give the doubtful mariner ample time to

* I use this term in preference to, and as more correct than "revolving."

"'bout ship" and change his course, and an opportunity for taking a "departure."

With reference to the precision with which a coloured light can be thrown from a lens or "*bull's-eye*" to certain distances, according to the *angle* of the bull's-eye, this must be proved practically. The matter appears at present to be involved in some uncertainty.

With regard to the *height* of lighthouses, I differ from Mr. Wells, of Somerset-house, (who proposed a distinguishing light some months ago in the *Illustrated London News*). That gentleman thinks the light should be as *near* the surface of the water as possible; I am of opinion that a lighthouse should be as *high* as possible, and for the following reasons:—The *higher* the light is, the farther can it be seen; nor does a light, being high, *deceive in distance* more than a low one—nay, not so much. The nearer the surface of the earth, the denser the atmosphere at all times, and the more liable to be variable. Every one who has been at sea, and, indeed, those who have not, may have observed that oftentimes, when the sun or moon has been shining, and there has not been a cloud to be seen, there has been a very thick haze (apparently a few feet thick) over the surface of the water, and which has prevented an object being seen till within a short distance. How often does it occur at sea that a ship "heaves in sight" all at once, and is reported "close?" And how often also does it occur in sighting a lighthouse, that the light is not seen till long after the captain had "expected" to see it by his reckoning. Doubtless, many a commander of a vessel oftentimes (though erroneously so) throws aside his (correct) reckoning, and calculates his distance from the light, without sufficiently thinking about the *state of the atmosphere* between him and the lighthouse; indeed, he may not have any reason to suspect a mist, as it might exist not more than half a mile from the shore. But if mariners knew that they could stand boldly on to a lighthouse till a coloured distinguishing light appeared under the main large one, they would never err.

Due notice (say one year) should of course be given to the whole world of any lights that were to come into operation on a particular date. A code of lights, such as that which accompanies this paper, for lighthouses—would also be necessary, and a printed key to places, "by authority," for the use of mariners.

To the accompanying code of lights for lighthouses, there may appear objections; these objections, however, may be partly if not wholly overcome. It may be said that when a ship approaches two horizontal lights, on either side, only *one* light would be apparent; true, but the vessel would only have to "stand on" for a very short time before the second light would "open" itself. Of course the two lights would only appear as one to ships making the lighthouse at one particular angle. The mariner might in a great measure be guided by the *colour* of the (supposed) one light that he saw. But if two lighthouses were seen at the same time, there could be no doubt.

With regard to the objections which may be raised to this code, they must be admitted to be minor ones (if even worthy of notice) and to be easily overcome.

If a "partition board" be placed a little between, and in advance of the two horizontal lights, it would "shut out" one light from the other, till the vessel had come to a certain "bearing"—to *know which* would be of importance to the mariner.

For *perpendicular* lights the same building would do; and it might even have *three* lights.

If other lights or signals be required at certain hours of the night at particular lighthouses, "blue-lights" or rockets may be used.

The "expense" of making our coasts perfect with lights should not be considered. How glady would shipowners and under-writers pay the expenses of lighting up our coasts *perfectly*. How much greater a sum for keeping up perfect lights would the owners of the *Great Britain* and the *Stephen Whitney* have been willing to pay, rather than that their ships should have met the fate they did!

If the Government would make use of the materials which are now lying useless and rotting, and of the dockyard lighters to convey those materials, a perfect set of lighthouses might in a very short time, and at a comparatively trifling expense be raised.

That the writer is not without some

small claim to a practical knowledge of the subject, on which he has now presumed to address the public, will perhap be allowed when he adds that he has made several voyages to and from England and China, and personally witnessed most of those evils which the adoption of a system of distinguishing lights would remove.

J. ASTON,
Madras Light Cavalry.

63, Cornhill, December, 1848.

Postscript.

It may be asked if my plan of "distinguishing lights" has been tried? No; it has not—it is so simple and certain that it does not require it. To make a trial on a small scale would give no more satisfactory proof than a demonstration on paper. But if trial there must be, the truth of the system may be proved from any lighthouse in one night, with the assistance of a boat at sea.

With regard to *a code of coloured lights*, and the distance which a coloured light can be seen, I am of opinion, that generally, there would be no objection to a vessel having to come a little nearer to land to see a light. It would be far better for a ship to be *certain* of her light, even though she had to come closer to the land. I have now had in view the objection which *might* be raised, that *coloured* lights would not be seen so far as plain ones. Is there a difference when both have the same power of light? And if there be a difference, would it be of any consequence?

If a coloured light cannot be seen so far as a plain one, and it be desirable in some particular situations for a light to be seen *as far as possible*, then let that light be used which will be the farthest seen.

As a commencement, I should suggest that a couple of carpenters (superintended by some person who understood the subject, and at the same time acquainted with mathematics and optics), should be employed by Government upon some lighthouse now existing to carry out my plan.

If it be found necessary to raise the roof, so that the main light may not be diminished, the lamp will also, of course, require to be raised.

J. ASTON.

[We do not think it necessary to give at length the code of lights which accompanies this interesting communication; but as the gallant author has returned to active service in India since the date of his paper we have thought it right to forward the Code, along with a copy of the present Number of our Journal, to the Trinity Board. The code exhibits 78 different positions in which discs and semi-discs of three colours, white, red, and green, may be placed—a number which might, of course, be increased to any extent deemed expedient. — ED. M.M.]

THE AMPHIBIOUS BAGGAGE WAGONS OF BRIG.-GEN. SIR SAMUEL BENTHAM.

Attention seems of late to have been turned to the means of conveying troops and baggage across rivers; and waterproof cases, to be inflated as rafts, are said to have been approved of by military authorities. The use of these floats will doubtless, in many cases, be very advantageous; but in addition to them, the introduction of Sir Samuel Bentham's amphibious baggage wagons *could* hardly fail to facilitate greatly, the operations of an army in any country intersected by rivers. The late Duke of York, in the year 1794, considered them as highly desirable, and expressed his wish that one should be constructed for trial of full size. One was accordingly built, and afterwards tried on the Thames to his Royal Highness's entire satisfaction; but by this time, Sir Samuel's engagements in the naval department completely occupied him, and, like other inventions where the originator does not follow up the introduction of his plans, the amphibious baggage wagon was lost sight of.

The waggon made for the Duke of York was, perhaps, the first vessel *the* hull of which was of metal,—it was of copper: the form of it nearly resembled that of a Thames wherry—the head and stern nearly alike. It was mounted on wheels, so as to be of easy draught on land; but so contrived that, without removing them, it could be driven into a river, and floated across it without derangement of the baggage with which it was loaded. Its form was such as to afford the greatest facility for its guidance in a stream by means of oars, one of them serving as a rudder. There

was a cover to this wagon of similar form and make, excepting that it had no wheels. This cover, when taken off, became a boat sufficient for the conveyance of a considerable number of men, ready on landing to protect the baggage or to join in any military manœuvre.

The form of wagon above described was considered as the most suitable for baggage; but where the wagon might be adopted for an artillery carriage, the form he contrived for this purpose was different: it much resembled the half of the baggage wagon, cut across at midships; the cover, being of the same form, had means of easily fastening its straight end to that of the lower carriage; thus the two together being of a form suitable for navigation, and the cover carrying many more men than those necessary for working the gun.

The first amphibious carriage which the General made was for his own use in the Ural Mountains. It was formed of two strata of very thin planks; that in which he afterwards travelled many thousand miles in the interior of Siberia, was of raw hides fastened upon ribs of light wood, after which the hides were made impervious to water by smoking them for a week over wood shavings. The covers of baggage wagons and artillery carriages might, for the sake of lightness, be made of the same material, or of any strong flexible substance made waterproof.

An amphibious baggage wagon, of full size, was afterwards built at St. Petersburgh, in the year 1807, and tried with complete success on the Neva. No objection of any kind has ever been brought against these amphibious vehicles, yet they are not anywhere in use.

The following note on this subject was found among Sir Samuel Bentham's papers:—

"In the pursuit of my investigations relative to the efficiency of vessels of war as subsidiary to land warfare, in the transport, landing, and protecting during debarkation the whole of the several branches of the expedition, I have been led to refer to expedients I had contrived whilst in the land service of Russia, for facilitating the crossing of rivers. This was effected by enabling the carriages in use for the conveyance of the material of an army, to pass a river, and to be in readiness for doing so in the course of a few minutes, without the need of any pontoons, or any additional matter, to form a bridge; indeed, without requiring additional matter of any kind, or additional horses for the conveyance of it during marches, all the carriages accompanying an army being adapted to this particular purpose; and in the Russian service they were sufficiently numerous to suffice, without additional ones, for the transport of troops across a river, as well as baggage. This expedient was not only exemplified in the way of experiment, but actually practised under Prince Potemkin, in the instance of a corps of chasseurs. This was but just before I quitted Russia on leave of absence, with the intention of returning to that service; so that no one took sufficient interest in the subject to pursue it, and to get the better of little difficulties that might present themselves to landsmen, nowise conversant with the nautical knowledge suitable to the case, so that I take it for granted that the idea was then abandoned. After that, when I was sent to Russia on a mission from this country, the Emperor Alexander having heard of the invention, requested me to have an amphibious carriage of the kind made.

"In this country, his Royal Highness the Duke of York being convinced of the practicability, as well as of the advantages of such amphibious carriages, was desirous of introducing them; and, at his request, I had one of them made, of full size, which was successfully tried on the Thames.

"At that time, although my baggage wagons would have been sufficient for the transport of infantry, I had not exhibited, or even contrived to my satisfaction, sufficient means for passing artillery over rivers, especially the largest pieces of ordnance; nor would the ordinary means of conveying it suffice. But since then, in considering the subject more in detail, means have presented themselves by which, at the same time that the conveyance of artillery on board ship in a state ready for immediate use would be effected, the landing it would be equally easy, as also the transport of it across rivers."

The following notes, written with a view to an intended "Naval Essay on the Structure of Vessels for Navigation," by General Bentham, have also sufficient relevancy to the present subject to be here inserted:—

"*Navigable Vessels. Indications as to Mode of Construction.*

"To trust to the tenacity, straightness of grain, sufficiency of thickness of the exterior planks of the bottom, the sides, and the

upper deck, as the chief ingredients of the strength of the vessel.

"To employ, for holding the planks together transversely, hoops of flat rods of metal, either on the outside, where this mode may be advantageous, as in the case of a vessel for carrying articles in bulk, or where pillars, struts, and other interior connections would be inconvenient; otherwise, to applying such flat rods to the inside, fastening them with screws, not to pass through, but to leave the exterior entire. Or, if wood be used, to bend it to the shape, taking advantage of the curvature which the fibres may happen to have more conformable to the shape than straight trees.

"Where hoops might thus be employed outside, cask-fashion, they might be of copper, and so arranged as not to project beyond the sheathing, to raise which some very thin wood, or some flexible material, as tarred paper or felt, might be employed.

"To use no grain-cut wood; but where the thickness renders it impracticable to bend the piece to the shape, rather to divide it into separate strata.

"To make the planks lap one over the other, somewhat like clinch-work, but to fasten them by screws from the inside, or by screw-pins, the nuts being on the inside, so as to obviate the mischief of caulking to close up the joints where they may appear to open. The edges of the plank bevelled, so as to leave the surface even and smooth; but perhaps the insertion of a tongue might be preferable.

"To dry and season the wood perfectly *before* it is applied and coaked together.

"To construct the vessel in a close building, ventilated and warmed at pleasure.

"To employ a cement like glue, but insoluble in water (whenever such a cement shall be contrived), to make the pieces unite together.

"The simple mode of construction, by placing confidence in the exterior plank, lining the inside with as few timbers or ribs as possible, seems the fittest mode, not only on account of its cheapness, but on account of the facility it affords of discovering the need of repair, and of effecting it with the least derangement of any parts than those found to be defective."

TIBBITT'S PATENT RAILWAY BREAK.

Fig. 1.

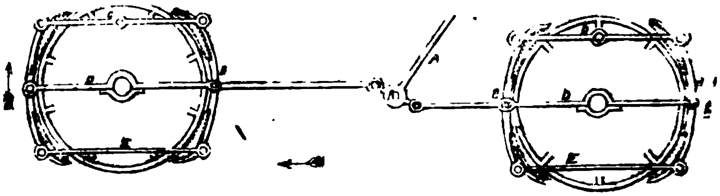


Fig. 2.

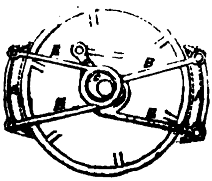
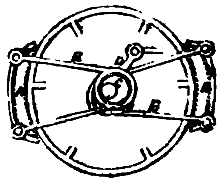


Fig. 3.



We now give, in Mr. Tibbitt's own words, the description of his improvements in retarding or arresting railway engines and carriages, to which we alluded *ante* p. 428.

Figs. 1, 2, and 3, of the accompanying engravings represent two arrangements for working the breaks.

In the first arrangement (fig. 1) four breaks are applied simultaneously to two wheels, one in the rear of the other (that is to say), two breaks to each wheel

by the downward pull of a single hand lever, A, which has its fulcrum on the axis, A[1]. BB are the breaks which are connected together by the rods, C, D, and E, by means of joints or pins. The upper rod, C, has a guide-pin, *c*, at or near its centre, which moves in a vertical slot in the under framework of the carriage, and the middle rod, D, which is prolonged beyond the inner break, and is jointed to one end of the lever, A, has an eye or bearing near its centre, which takes upon the axle of the carriage. It will be seen that when the lever, A, is upright, the breaks stand clear of the wheels. When, however, the lever is pulled towards the hinder part of the train or carriage, the upper portion of the fore-break and the lower portion of the hind one, rub upon the periphery of the wheel, at which instant they become self-acting, and are then made to grip by their own friction until released, or the train or carriage is stopped.

Figs. 2 and 3 show another arrangement for stopping the wheels of carriages. The breaks are represented in fig. 2 as being out of action, and in fig. 3 as being applied to the wheel. AA are the breaks, which are connected by the looped rods, BB, to a double eccentric, C, which has its bearing upon the axle of the carriage. When the lever, D, is pulled to the right, as in the position represented in fig. 3, the eccentric causes the break to be drawn up against both sides of the wheel at the same time.

ON THE CARBONIZATION OF WOOD BY SURCHARGED STEAM. BY M. VIOLETTE.

(From the Comptes Rendus de l'Academie des Sciences, for June 19, 1848.)

Charcoal, as it is prepared and used for the manufacture of gunpowder, and particularly for that for sporting, differs much from pure charcoal, and contains other constituent matters of the wood. The proportion of these matters, which varies with the mode of preparation and the degree at which the charring is stopped, modifies considerably the properties of the powder. For this reason, in practice, the different kinds of charcoal are carefully separated, from the first degree of charring or brown charcoal (*charbón roux*), to the black charcoal, which is the most completely carbonized.

In the first part of my memoir, after recapitulating the different varieties of charcoal, I gave an account of my experiments to determine the successive phenomena of charring in close vessels, and the effects of exposing the wood to different degrees of temperature. I have ascertained that at the temperature of 200° (392° Fah.) wood is not charred; that at 250° (482°) there is obtained an imperfect charcoal, called *brulots*; that at 300° (572° Fah.) the brown charcoal is formed; and that at 350 (662 Fah.) and above, the operation invariably gives the black charcoal. The time necessary for the carbonization varies from half an hour to three hours, and the products pass at will from the brown to the black charcoal. I then examined the yield of charcoal, which is less in proportion as the charring is more advanced.

In the second part of my memoir, I gave an account of my labours to apply the principles laid down in the first part to the charring by steam. MM. Thomas and Laurent, civil engineers, having had the happy thought of applying surcharged steam to the reviving of animal black, I thought that it was possible, by analogy, to extend this process to the carbonization of wood. I found in the first experiments made with a small apparatus, not only a slight gain in the force of the powder, but a much more considerable yield of charcoal. After this first result, the Minister of War advanced me 5000 francs (1000 dollars) for the erection of an apparatus on a large scale. In this apparatus the steam is supplied by an ordinary boiler, and passes into a worm wound in a helix. The tube is 0·020 m. (nearly 8 inches) in internal diameter, and 20 metres (22 yards) long; the steam surcharged by the heat of the furnace arrives at a determinate temperature, 300° (572° Fah.) for instance, to obtain brown charcoal. It surrounds and penetrates into a horizontal cylinder containing the wood, and chars it; it then leaves the cylinder charged with the products of the distillation. This apparatus has been in regular operation for nearly a year at the powder mills of Esquerdes, which are under my charge, and supplies exclusively and advantageously the charcoal for the sporting powder. The drawing of it is appended to the present memoir.

According to the Tables which I present of the results obtained in its present working, I have generally obtained from 33 to 37 of charcoal from 100 of wood; as a mean 35 per cent. of brown charcoal, and 2 per cent. of *brulots*, but no black charcoal. The yield has sometimes been more than 39 per cent. of brown charcoal.

By the old method, as a mean, 18 per

cent. of brown and 14 per cent. of black charcoal were obtained. Thus it is seen that the proportion of the charcoal which it is desired to produce, is twice as great by the new as by the old process. It is also easy to produce the black charcoal by raising the temperature above 300° (572° Fah.) The preservation of the steam within determinate thermometric limits (a condition indispensable to the success of the operation) is easily obtained by the adjustment of the stop-cock which admits the steam;—this is a great advantage essentially belonging to this new method. The examination of the expense of production is also in favour of the new process.

I then point out the modifications which, according to my observations, might be made in the construction of a new apparatus. That which is now in process of construction upon this data, at the powder mills of Saint-Chamas, will combine the most favourable conditions for this mode of carbonization.

I then enter into some considerations upon the different proportions of materials to be used in powder, according to the degree of carbonization, and the yield of the wood; the volatile matters which the charcoal still contains, being at some times double the amount which at other times occurs, and forming occasionally two-fifths of the charcoal.

The quantities of the components of the powder are numerically the same in all the powder mills; but not really so, because the charcoals used, coming from different methods of fabrication, are of variable composition. The exact analysis of different charcoals, which I am about to undertake, will, however, show the true value of this assertion; and I shall have the honour, hereafter of presenting this work to the Academy.

I conclude by pointing out what useful resources the surcharged steam may present to all branches of industry, which employ heat within the thermometric limits of 100° to 500° (212° to 932° Fah.)

The baking of bread and sea biscuit takes place perfectly in a current of steam heated to 200° (392° Fah.) Successful experiments upon this subject have recently been made at Esquerdes, in presence of an engineer sent by the Minister of the Marine; the continuous baking of bread, so long and vainly sought for, is finally practised by this process. The cooking of meat may also be accomplished by it, and we may be permitted to think that culinary apparatus of this kind, both for large and for private establishments, will replace the old apparatus, the use of which is so dangerous; here there is no peril, for the heated vapour has but a feeble tension (at most half an atmosphere) above the pressure of the air.

The extraction of wood vinegar (*pyroligneous acid*), may also, without doubt, be easily accomplished by this new process; for on the one hand, the condensed steam carries with it, and contains all the products of the distillation without any loss, and on the other hand, the adjustment of the stop-cock for admitting the steam, allows the temperature to be so regulated as to insure the maximum yield of acid. It will also be possible, perhaps, to avoid the formation of that empyreumatic oil which always accompanies pyroligneous acid, and gives it that disagreeable character which does not permit it to be substituted for vinegar.

The extraction of wood alcohol (*pyroxylic spirit*), may also be advantageously accomplished by seeking for the thermometric conditions necessary and sufficient for its maximum formation.

In fine, the drying of wood may be accomplished by this process with the greatest ease; and the new and strange results which I have obtained, as to the resistance of different kinds of wood, dried at high temperatures between 100° and 250° (212° and 482° Fah.), will be the subject of a memoir which I shall soon have the honour of submitting to the Academy.

BADDELEY'S UNIVERSAL SPREADERS FOR FIRE AND GARDEN ENGINES,

[Registered under the Act for the Protection of Articles of Utility.)

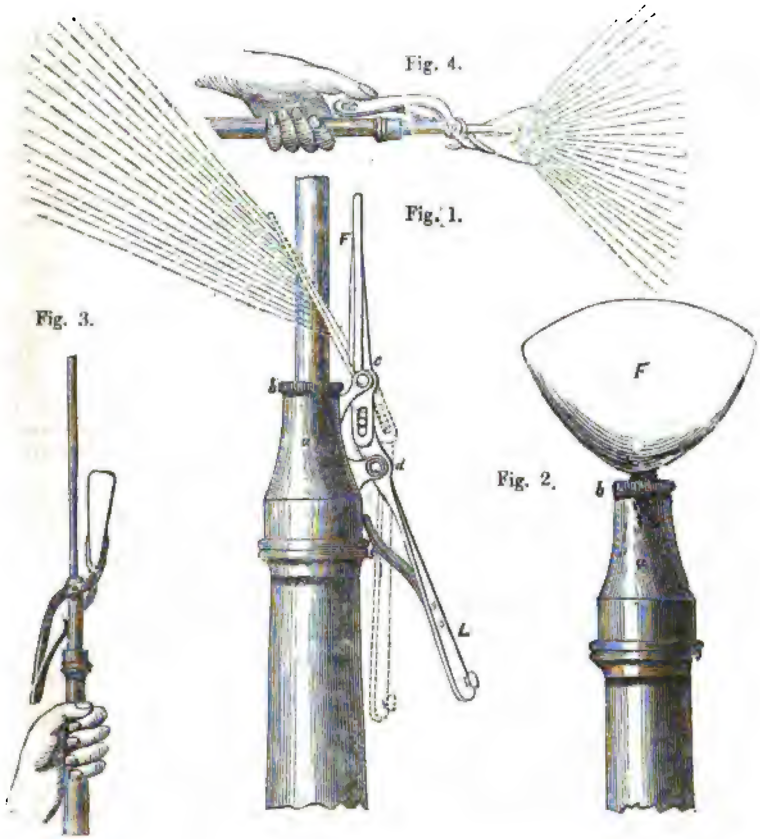
Sir,—More than half a century has elapsed since M. Van Marum demonstrated by several notable public experiments, "that a very inconsiderable quantity of water, *if judiciously directed*, would extinguish a very violent fire."

The successful experiments of M. Van Aken with an anti-incendiary composition (of which clay and water were the principal ingredients) gave rise to those of M. Van Marum, who undertook to prove that water alone was more efficacious for extinguishing fire, than the anti-incendiary liquor!

Applied in a similar manner, however, there can be no doubt of the superior extinguishing property of the clay solution (for which, by-the-by, a patent was taken out in England in 1844, by the ingenious, but unfortunate Cameron). M. Van Marum merely proved the Poet's celebrated truism.

"Whate'er is *best administered*, is best."

A detailed account of the experiment



above alluded to, was published in vol. iii. of the *Mech. Mag.*, page 185. M. Van Marum recommended the use of ***small portable pumps***—throwing the water in such a way that ***the entire surface*** of the burning part shall be wetted and extinguished—and that ***no more water*** be thrown on the burning part than is needful to ***wet the surface.*** Notwithstanding the value and importance of the facts so strikingly exemplified, practical firemen have been slow in appreciating or adopting them; they have ever advocated the employment of powerful engines and unlimited supplies of water, so as to ensure a certain and easy triumph over their elemental antagonist. When we consider the heavy responsibility which attaches to this employment, and the dangers incurred, this feeling is, perhaps, inevitable. Scientific men will, however, study how to make the best use of limited means, in case no other should be at hand—taking machines of small power, with scanty supplies of water, and making the most of them.

In 1793, Mr. Bramah patented a perforated boss for fire-engines, by which the water was so spread and divided as to cover and wet a large surface, and thereby extinguish a considerable fire with the smallest quantity of water; a description of this apparatus appeared in your xxvi.th volume, p. 472. Bramah's perforated boss, however, never came into general employment, and on enquiring into the probable causes of its disuse, I found it liable to several objections. In the first place, it became necessary to stop working the engine to

admit of the boss being affixed or removed from the branch pipe; and secondly, however carefully the total area of the perforations might originally have been adjusted to the power of the engine, when working under the circumstances ordinarily attending fires, a great many of the holes would speedily become choked up, and strain or burst the hose. From a careful consideration of all these circumstances I was led to devise an apparatus possessing all the required capabilities without being open to similar objections, and I succeeded to my entire satisfaction.

In May 1842, I registered a *Spreader*, of which fig. 1 is an edge, and fig. 2 a front view; it consisted of a collar or socket *a*, which could be slipped on to the ordinary nozzle of a fire-engine branch, the beard, *b*, unscrewing for that purpose.

Upon the socket, *a*, were two projections, *c d*, which formed fulcra for the fan or spreader, F, and the lever L. The upper end of the lever L, worked between a forked tail-piece on the lower end of the fan, upon which it acted by a cross pin moving in two side slots. A spring, *s*, kept the fan and lever in such a position, that the fan was always out of the way of the jet, until purposely brought over it by pressing down the lever L, as shown by the dotted lines, when the water will be deflected and the jet scattered over a larger extent of surface in small drops. The greater the velocity of the jet, the finer is the division of the water. I have in this way frequently produced a *fine dew*—and in the sun's rays a most beautiful rainbow. By means of this apparatus a small quantity of water becomes available for the extinguishing of a large extent of burning surface, such as fires in hay and corn sacks, weather-boarded buildings, &c., where the jet is comparatively unavailing. These spreaders were manufactured under an exclusive licence, by Mr. Merryweather of Long-acre, and were first adopted by M. J. Whitty, Esq., then Head-Constable and Superintendent of the Fire Police in Liverpool. The Spreader has since come into very general use in nearly all parts of the kingdom; it was used by Lord Thurlow, at incendiary fires in the agricultural districts, with very remarkable advantage.

In Mr. Braidwood's book "on the Construction of Fire-engines, &c.," (p. 85,) he says, "if on entering an apartment it be found that the flames cover a considerable space, it is of advantage in some instances, to place the point of the thumb in contact with the water at the nozzle; by this means the water may be spread to cover any space under 20 or 30 feet, according to the pressure applied." There are several objections to this mode of proceeding, the principal one is, that the aperture of the nozzle being thus constructed, a bursting pressure is thrown upon the hose and engine. At a fire in Bermondsey some time back, when thumbing the nozzle to spread the jet over a burning tan stack, the hose gave way. The thumb is also liable to be cut open by stones, &c., forcibly carried along by the water, some awkward cases of which have come under my observation. With the spreader permanently deflected (by its accompanying strap) the branch may be left where a man could not stand to thumb it.

Pursuing the subject further, I was led to devise an *engine* for the *spreader*, and produced the Farmer's fire-engine,* which (although somewhat more powerful than contemplated by M. Van Marum,) has been pronounced the *ne plus ultra* of fire-extinguishing machinery.

More recently I succeeded in simplifying the spreader, so as to adapt it to garden engines, and horticultural purposes, in which form it is shown by figs. 3 and 4, the former representing it in a *passive*, the latter in an *active* state. This form of the invention was purchased of me by Messrs. Warner and Sons, by whom it was registered in February, 1848. For horticultural purposes three kinds of spreaders had been previously employed, viz., the *perforated rose* (like that of a watering-pot); the *slit* formed by two plates of metal, of a fan shape, brought together so as to present a thin aperture through which the water being forced it flew off in a divided sheet; lastly, the *scoop*, which divided and deflected the jet. The two first were continually choking up with dirt, leaves, insects, &c., while all three had to be screwed on and off, and being detached were liable to be lost.

In my spreaders the jet is not acted

---

* Described in vol. xlvii., page 300, and vol. l. page 526.

upon until after it has quitted the nozzle of the engine; no choking can therefore occur,—a circumstance which enables them to be successfully employed for the distribution of liquid manure under pressure, as stated by Mr. Chadwick in his recent Report on the subject of liquid manures, to the Commissioners of Sewers.

I remain, Sir, yours respectfully,

WM. BADDELEY.

29, Alfred-street, Islington, June 19, 1849.

SQUARING OF NUMBERS.

Sir,—I have for some years squared two-figure numbers upon the principle stated by your correspondent, "C. G. O.," in No. 1340, p. 343; but with an arrangement of the operation which adds much to its facility.

To square a number of two places, proceed thus. Write down in a line the square of the separate digits, from left to right, to which add double the product of the digits, written one place to the left. A few examples will make this clear:—

```
      6449        1625        3616
     112          40          48
     ----        ----        ----
(87)² = 7569  (45)² = 2025  (64)² = 4096
```

If the square of the unit digit is not a two-figure number, a cipher must be prefixed to make it such; thus, 1^2, 2^2, 3^2, must be written 01, 04, 09.

```
      4904          8101
     28            18
     ----          ----
(72)² = 5184  (91)² = 8281
```

The letter of your correspondent led me to consider if a rule could not be framed for squaring any number; the result is the following, which reduces the labour by one half.

Rule.—Write down in a line the squares of the separate digits taken from left to right (making every square to consist of two figures, by prefixing ciphers if necessary); then multiply all except the last figure in the number to be squared by double the last figure, and place the product beneath the said squares one place to the left; proceed in the same manner with the remaining figures continually, until they are exhausted, but writing each successive product after the first, two places farther to the left.

```
(1) Square 543214      (2) Square 34652      (3) Square 8604

    251609040116          916362504             64360016
         434568               13860                6880
       10864                3460                 96
      2172                408                   --------
    324                   24                    74028816
   40                     ----------
   ------------           1200761104
   295081449796
```

When a digit is 7, 8, or 9, its double will be 14, 16, 18, in which cases it will be better to multiply by the digit, and write the product down twice.

```
(4) Square 627385

    360449096425
         627380
        50184
        50184
      3762
     434
     434
    24
    ------------
    393611938225
```

The preceding rule readily follows from that for squaring an algebraical polynomial

$$(a + bx + cx^2 + dx^3 + \&c.)$$

when $x = 10$, although it was not until I had completed the above, and suggested it to a friend as the easiest way of squaring algebraical expressions, that I was aware that such a rule had been given.

I am, Sir, yours, &c.,

W. O.

Islington, May 16, 1849.

We have before expressed the high opinion which we entertain of Mr. Noad's labours as an electrician. (Vol. xl., p. 57.) The present edition of his Lectures is enriched by an additional one, in which he gives the best account we have yet met with of the late remarkable researches of Matteucci on Electro-Physiology. Some readers may ask why the term "Electro-Physiology" is used—why not "Animal Electricity?" The reason is, that Matteucci's researches have led him to the conclusion that there is no such thing as animal electricity, and that the phenomena ascribed to the existence of such an element, by Reymond and others (see ante, p. 565,) belong to something perfectly distinct, which he proposes to denominate (Animal?) *Ether*. The following extracts will suffice to give the reader a general insight into this eminent philosopher's views on the subject:—

Matteucci has sought unsuccessfully for an electrical current in the nerves of a living animal. He introduced steel needles into the muscles of living frogs, rabbits, and dogs, in various directions relatively to the muscular fibre, and connected them with the terminal plates of his delicate galvanometer, but could obtain no indications of an electrical current, nor was he more successful with the galvanoscopic frog; he subsequently tried the experiment on the sciatic nerve of a living horse, but without obtaining any trace of an electric current. Indeed, from what is known of the properties and laws of propagation of electricity, it seems impossible to conceive the existence of an electrical current included in the nerves; in order to admit it, such a disposition in the structure of the nervous system as would suffice to form a closed circuit must be proved, but this anatomists have not yet done. Matteucci made the following experiment, in order to ascertain, in an indirect manner, whether the nervous system might readily form a closed circuit for the electric current. He laid bare, in two different points of its length, as far from each other as possible, the sciatic nerve of a living animal: viz., above the thigh to the extremity of the leg. He introduced the limb into a spiral in connection with a smaller spiral containing an iron wire; he then touched the points of the uncovered nerve with the extremities of a pile, in order to send a current through it, but no satisfactory indication of an induced current could be obtained.

The electric current, then, does not exist in the nerves of a living animal: the laws of its propagation require conditions which are not found in the nervous system, and it is certain, that the nervous force, whatever it may be, is not *Electricity*. What relation, then, is there between these two forces? Matteucci's laborious electro-physiological inquiries led him to the following conclusions. There exists between the electrical current and the unknown force of the nervous system an analogy, which, if it be not susceptible of the same degree of evidence, is, however, of the same kind as that existing between heat, light, and electricity. In all the phenomena of electric fishes, the faculty of producing electricity, with which they are endowed, is under the direct dependence of the nervous system: and there is in these animals a structure, a certain disposition of particular parts of their organism, which, by the agency of the unknown force of the nervous system, enables them to disengage electricity. The parallelism which has been clearly shown to exist between muscular contraction and the electric discharge of fishes, proves distinctly that the two functions depend immediately on those of the nervous system.

The development of Electricity by a crystal of tourmaline when heated, clearly proves the relation between heat and electricity; a similar relation between the nervous force and electricity is demonstrated by electric fishes. Electricity is not, however, the nervous force, any more than *heat* is electricity: the one changes into the other in the one case, by the form of the integrant molecules of the crystal; and in the other, by the structure of the electric organs. In physics we are daily advancing towards a simplification of our hypothesis, or more exactly, towards a single hypothesis serving to explain all the phenomena of heat, light, and electricity. "What hypothesis, indeed," says Matteucci, "is more worthy of the rank to which it is sought to be elevated than that of a body which is capable of a variety of different movements, susceptible of transformation from one into the other, and so representing phenomena very different from each other?" The most essential characters of this body, such as the immense rapidity in the propagation of its motions, the transformation of one motion into another, &c., belong to the unknown force of the nervous system, as to electricity, light, and heat.

. . . .

Heat, mechanical or chemical action, may, like the electric current, arouse the excitability of a nerve, and thus produce contraction and sensation. Are we hence to conclude that these chemical, mechanical, and calorific actions are transformed into an electric current, which alone has the power of exciting a nerve? We should be by no means warranted in drawing such a conclusion; and as it has been proved that the unknown power of the nervous system is not electricity, so we have no reason to believe that stimulants—viz., heat, chemical or mechanical action—act by producing an electric current when applied to a nerve.

We may conclude, then, with Müller, that the electrical current, which under certain conditions traverses a nerve, determines in it a change similar to that produced by the unknown force of the nervous system, when it is there excited by external actions, or by the action of the will.

It seems, however, natural and just to suppose that the change effected in the disposition of the elementary organs of a nerve, whether by the act of the will or by the electric current or other stimulants, is accompanied in every case by a species of current of the unknown force of the nervous system. This force Matteucci denominates *Ether*, in order to explain by one hypothesis all the phenomena of imponderables, and the analogy of the nervous force with these other forces.

All philosophers agree in the impossibility of explaining the immense rapidity of the propagation of light, of radiant heat, of electricity, without having recourse to *vibratory motion*. The unknown force of the nervous system is not less rapidly propagated. Ether distributed through all points of the nervous system, as through the whole universe, takes the character of the nervous force, through the modifications introduced in the relative disposition of the molecules by the organization of the nervous substance. The different structure of the nervous fibres, and especially that of their origin and extremities, such as the microscope is now unfolding, may serve to explain why the molecular change of the nerve which constitutes its excitable state, is less rapid in the ganglionic system than in the other nerves, and why, in certain nerves, the excitability is propagated only in a certain direction.

The nervous fluid in this hypothesis is what we suppose heat, electricity, and light to be, viz., a peculiar vibratory motion of ether.

To sum up in a few words these hypothetical views:—There is in all parts of the nervous system, as in all bodies in the universe, a *diffused ether*, which in this system may have a particular arrangement, as it is admitted to have in certain crystalline bodies. When the organic molecules of the nerves are from any cause deranged, the ether, or more properly the nervous fluid, is put into a certain motion, which reaching the brain produces sensation, and arriving at the muscles determines contraction. This derangement may be produced by the electric current, by heat, by chemical and mechanical action, as it is naturally by the will; the propagation of the motion will be materially interfered with by any alteration whatever in the structure of the nerve.

Matteucci concludes by offering the following explanation of the action of the electric current on the nerves:—

Let it be admitted that the electrical current, which traverses a nerve in the direction of its length, determines a derangement in the direction of this current, as the experiments of Porrett and Becquerel have proved; let it be admitted that this derangement is accompanied by vibratory movements of the nervous fluid, which are propagated to the extremity of the nerve parallel to the direction of the organic derangement. This current of the nervous fluid produces *sensation* if directed from the extremities towards the brain, and *contraction* if directed from the brain towards the extremities. From this it follows that an electric current traversing a nerve *normally* can produce no phenomenon. The direct current produces contraction when it enters, and sensation when it ceases. The inverse current, on the other hand, produces sensation when it enters, and contraction when it ceases. The phenomena observed during the first period of the vitality of the nerve show that when the organic disposition of the nerve is perfect, its molecules are deranged in every direction by the application of any kind of stimulant, but always more so in the direction of the electric current than in the opposite direction. In proportion as the structure proper of the nerve ceases to be perfect, the phenomena produced by the current are those which take place in the direction in which this force acts with the most intensity. Other stimulants produce in the structure of the nerve a derangement of a more permanent nature, and which, unlike that produced by the electric current, does not cease till the exciting cause is removed. An electrical current which traverses a nerve for a certain time, finishes by permanently deranging its molecules, hence the reason why the prolonged action of the same current ceases after a time to produce its peculiar action on a nerve. A current in the contrary direction will bring back the molecules of the

nerve into their former condition, and restore to them the capability of being excited by a current in the same direction as the first. The passage of an electrical current through a nerve in a different direction, the successive interruption of this current, and its greater intensity, are the causes most likely to produce a permanent derangement in the structure of a nerve.

The additional lecture from which we have made these extracts, concludes with some remarks on "Therapeutic Applications of Electricity," which will be found particularly deserving the attention of medical men. "Hitherto," as Dr. Golding Bird lately observed in a paper read before the College of Physicians, "electricity, as a remedial agent, has been by no means fairly tried; for it has been either exclusively referred to when all other remedies have failed, or its administration has been carelessly directed; and the mandate, 'Let the patient be electrified,' merely given without referring to the manner or form of the remedy." Mr. Noad shows, by well-authenticated experiments and good philosophical reasons, that it may be expected to be used with advantage, in all cases of paralytic affection (though by no means immediately so, Matrianini having to give a patient no less than 2500 shocks before effecting a cure)—of tetanus, muscular contraction, amaurosis, deafness, and cholera (in the last case by taking sparks from the spine;) but that nothing is to be hoped from it in cataract and the stone. With respect to the best modes of application, Mr. Noad observes—

For the medical application of voltaic electricity, the simplest, and, on the whole, the most convenient form of battery, is the old *Cruickshank* trough; the exciting agent being dilute sulphuric acid. The mode of application may differ in different cases; when it is to be applied on the surface, the current may be transmitted through the medium of *sponges*, or, what is perhaps more convenient, by means of saddles of thin sheet copper covered with thick flannel, and saturated with brine, the surface of the skin being also well moistened with salt and water; it is sometimes, however, desirable to act on parts deeply seated below the surface; in such cases, the following method of M. Sarlandière may be adopted:—Needles of steel or platinum are introduced, as in the process of acupuncturation, the needles being connected respectively with the two opposite ends or poles of the battery. Becquerel considers this to be the most efficacious mode of applying electricity, since it permits the operator to act directly on the diseased part.

It was first noticed by Marianini (820), that the force of the shock differs considerably, according as the current goes in one direction or another; thus, if a person grasp two conductors connected with the poles of an extensive voltaic battery in vigorous action, he will experience a much more powerful muscular contraction in the arm which is in communication with the *negative* than in that connected with the *positive* end; so also, if the current be passed down the arm from the shoulder to the hand, the latter being immersed in a basin of salt water, a powerful contraction is experienced; if, however, the current be passed from the hand to the shoulder, the contractions are much less violent, and the difference is observed most strikingly in paralytic patients.

The following explanation of these differences is offered by Marianini:—The action of electricity on the muscles and nerves produces two distinct kinds of contractions; the first, which he calls *idiopathic*, are the result of the immediate action of the current on the muscles; and the second, which he calls *sympathetic*, arise from the action of electricity on the nerves which preside over the motions of the muscles. Now, *idiopathic* contractions are necessarily produced in whatever direction the current of electricity passes; but the occurrence of *sympathetic* contractions must be governed by the direction of the passing current; they can only take place when the electricity is transmitted in the direction of the ramification of the nerves; the shocks then experienced when the current is transmitted from the shoulder to the hand are more powerful than those passed in the reverse direction, because in the former case the electricity is transmitted in the direction of the ramifications of the nerves, and in the latter in the contrary direction. These facts, which the researches of Matteucci confirm and illustrate in a satisfactory manner, will serve as a valuable guide to the electrician in his treatment of cases of paralysis by this form of electricity.

Mr. Noad excuses himself, on the plea of want of space, for leaving untouched the recent splendid discoveries of Faraday relating to the magnetic and dismagnetic condition of matter; but if he wishes that his work should maintain the standard character it

has acquired, he will find it absolutely necessary in his next edition to find room for these in some way or other; by recasting, probably, the whole work, and eliminating much ancient matter, which is rather historically interesting, than now-a-days practically useful.

THE CASE IN EVAPORATION.

Sir,—In the article in your last Number on Evaporation, page 590, I recognize the "Engineer" whose answer accompanies the case inserted in No. 1841, page 367, and is there commented on. The writer misapprehends entirely the point on which the strength of my argument is intended to rest. Whether the steam within the boiler which comes into contact with the pipes is actually reconverted into water (*under a temperature* 328°), or the whole contents are reduced to 231°, is perfectly immaterial. I think it will not admit of a doubt that 7 degrees being abstracted by the cold water, the actual evaporation from this boiler will be that due to 231°, although 238° are constantly given out from the furnace. I have no disposition to higgle as to terms, or to make distinctions where there are no differences. I merely remarked incidentally that there could be no condensation, as the term was generally understood, at the temperature of 231°; whether right or wrong, it had nothing to do with the main question. It appears to me that the whole rests on very simple grounds. Does heat radiate alike in all directions? Is not a surface of water in contact with heat as susceptible to its influence, as a surface of metal or any other solid? When this heat exceeds 212°, will not the surface be converted into steam, and will not this steam carry off all the superfluous heat, and thereby prevent its penetrating to any depth? Can it make any difference whence this heat is derived? From a red-hot plate of iron (which will convert the surface of ice into steam), from steam of a greater pressure and higher temperature, or from *superheated* steam?

If I am right in believing that steam may be created by heat applied to the surface of water, I conceive that all my other propositions follow as a matter of course. I forbear from any comments on the truisms set forth by "G. D." as to the *measure* and *intensity* of heat;—they are better adapted to normal schools than to the consideration even of MERELY PRACTICAL engineers. But his admission that "heat applied superficially is certainly not lost, but will cause *slow evaporation*," is the entering wedge: let him follow up the consequences.

I am, Sir, yours, &c.,

F. B. O.

MR. GOLDSWORTHY GURNEY'S PLANS FOR THE PREVENTION OF EXPLOSION AND FIRE IN COAL MINES.

The benevolent and highly scientific plans of Mr. Gurney, for diminishing the frequency, if not entirely preventing the occurrence of accidents of mines, occupied a prominent share of the attention of the House of Lords on a recent evening, and from what passed on the occasion—more especially, the marked testimony borne to their efficacy by the President of the Council, the Marquis of Lansdowne—their enforced adoption to a greater or less extent, at no distant date, may be now looked upon as nearly certain. With Mr. Gurney's application of high-pressure steam to the *ventilation* of mines our readers are already well acquainted (see *Mech. Mag.*, vol. xlix., p. 633, and vol. xxxviii., p. 97; but his plans embrace also one for the *extinction of fires* in mines, of which we have not hitherto had an opportunity of giving any account. The latter was thus noticed by

Earl St. Germains.—A colliery in the neighbourhood of Manchester was on fire. Formerly there was no mode of extinguishing it except by pumping in water in a considerable quantity and by pumping it out again afterwards—an operation of some labour and considerable expense. Mr. Darlington, the proprietor of that colliery, having heard of Mr. Goldsworthy Gurney's experiments, applied to him in writing to come down and extinguish that fire. Mr. Gurney, in reply, told him that he had no doubt that carbonic acid gas could be driven through the mine so as to extinguish the fire. Mr. Darlington acted upon the opinion of Mr. G. Gurney, and had since acquainted the public that the fire was extinguished at a cost of fewer pence than there would have been pounds had the old system of pumping in and of pumping out been adopted. The fire was extinguished, and Mr. Darlington declared that the mine was now perfectly ventilated.

The following is Mr. Darlington's

own account of the affair; it is so extremely interesting that we do not hesitate to give it at full length:

"On Monday morning, April 2, one of my coal mines at Astley, was discovered to be on fire, and had spread to such an alarming extent as to prevent all access by the usual shafts. We immediately put out all the fires about the works, and requested the cottagers in the neighbourhood to do the same, for fear of an explosion. The plan of procedure in such cases (which happen more frequently than those unacquainted with collieries suppose) is, first to stop down all openings into the mine, so as to prevent any access to the atmosphere. If, after some time, the fire is found not extinguished, the only alternative is to fill the mine with water from some source in the neighbourhood. In the absence of a sufficient reservoir of water the pumps are stopped, and the water allowed to accumulate from the natural drainings, generally an unsatisfactory and slow process. In the former plan, notwithstanding every precaution is taken in sealing the shafts, it is found by experience that air in small quantities will be drawn through the stoppings and fissures of the earth sufficient to keep up a slow rate of combustion for a very long period. We have proof of this in many cases occurring in this neighbourhood. In the extensive collieries worked by Lord Bradford, at Bolton, the mine has been on fire nearly two years. When the fire happened it was sealed up for some months; but, on opening it, the fire was still found burning. The pits were again immediately sealed up, and left to remain for twice the former period. On opening the mine at this time the fire burst out as before. It was again closed, and so remains to this day. At the collieries of the Earl of Ellesmere, at Worsley, one of the mines took fire about the same time; it was treated in the same way; it is still on fire; and, at this moment his Lordship is about to turn in the Bridgewater Canal. In the Patricroft Colliery, the deepest mine in this county, a fire broke out in the upper part of the workings, which baffled every attempt to extinguish it, and is now stopped up and abandoned. At Mr. Blundell's colliery, at Blackrod, in this district, the pits were opened after being closed some weeks, on account of fire, when a fearful explosion took place, and did considerable mischief to the workings. The fire burned with greater intensity than ever: the flames rose out of the mines and set fire to the head-gear, and burned so fiercely within the pit that it actually melted the iron tram-wheels. In this case the river Douglas was eventually turned into the workings so as to fill them with water. I could mention several other cases in this immediate neighbourhood to show the importance of the question before us, and the difficulties we have to contend with when these unfortunate accidents occur. In our case we instantly sealed up the mine, yet fire-damp issued from every crevice about the stoppings, and through orifices in the earth, in such quantities that the safety lamps would take fire at a considerable distance. In this state of things I wrote to Mr. Goldsworthy Gurney, whose application of high pressure steam to the ventilation of coal mines is exciting so much interest, stating the case, and asking if he could point out any plan by high pressure steam exhaustion, or otherwise, likely to be of service. Mr. Gurney immediately came down, and after well investigating the conditions, in consultation with us, proposed to fill the mine with carbonic acid, azote, or some other extinguishing and incombustible gas. This, at first, appeared to us impracticable, and the immense quantity required to fill the galleries and lateral workings, together above three miles in length, too expensive, if it were possible to obtain it, to warrant the proposition. He, however, soon set us right. He said nitrogen, or azote, might be obtained from the winds of heaven, and carbonic acid from the coals lying waste about the pit, assisted by a little charcoal and lime; air would be deprived of its oxygen by being passed through burning charcoal, coke, and small coal, and the azote set free. In short, the product of this combustion would be the choke, or black damp known in mines. We immediately built a furnace of brickwork, four feet square, at a safe distance from the downcast shaft. To the ash-pit, in every other respect made tight, an iron cylinder 13 inches in diameter was connected, and made to terminate at an elbow under water in a close tank partly filled. With the upper part of this tank, above water, another pipe was connected and carried through the stopping of the downcast pit. A powerful steam jet was made to work between the furnace and the tank, which drew the air down through the fire, and forced it through the water. A second jet was placed in the cylinder at the top of the downcast shaft, and made to draw the choke damp from the tank, and force it into the pit. At the other, or upcast shaft, we placed a jet in a cylinder through the stopping, and made to exhaust from the shaft beneath, so as to assist the compressing jets, and draw the choke damp through the galleries between them. The apparatus thus fitted, as soon as the fire had burnt up, was set in action. In order to test

the effect of the choke damp, we placed some burning tow, moistened with spirits of turpentine, into it. The flame was as instantly extinguished as if placed in water. It was thus tested in the cylinder, as it passed from the ashpit, before coming to the jet; also in the tank and second cylinder, with similar results. This was conclusive evidence of the perfect formation of the choke damp. In about two hours after the jets were set in action fire damp disappeared from the shafts, and we observed a slight cloudy appearance in the escapage from the upcast shaft. It had the sulphurous smell of choke damp, which pervaded the air to a considerable distance. A safety lamp was now brought and placed in the upcast cylinder; it became instantly extinguished as if put in water. For this purpose the draughts were momentarily shut off. A bright burning fire of charcoal, in a chafing dish, was placed in the escapage of the cylinder, and was also immediately extinguished. These facts satisfied us that the choke damp had passed through the mine. The period of its appearance agreed with our calculations. The quantity of choke damp forced through the mine was about 6,000 cubic feet per minute, and this would fill the galleries in about that time. The choke damp was allowed to remain for several hours, at the termination of which we were convinced that all fire, however intense, must be extinguished in the mine. The connection with the furnace was now broken, and fresh air driven through by the same jets. In about two hours the choke damp disappeared; this was shown by a safety lamp burning clearly in the escapage, in the cylinder at the upcast shaft. We regarded the mine now as perfectly safe. With several men I descended the downcast shaft, 390 feet deep, to the tunnel leading to the working. We found all clear. The exhausting jet was kept up, drawing fresh air through the mine all night. The next day several men went down and passed through the workings, and found all clear and safe. Their report was particularly favourable. In no part of the mine could they perceive any fire, and the action of the single jet in the upcast is described by them as passing a current with greater speed than the furnace (which is pronounced to be the most effectual one in the county) had ever before done in this or any of the other mines of which I am the proprietor. This result has occasioned the greatest interest in our neighbourhood. Never was an experiment more successful. A gigantic power under such complete control, fighting with the elements, and, as it were, compelling them to destroy each other. The application of high-pressure steam to the ventilation of coal mines may effect a greater protection to life and property, but we regard this application as little inferior to the coal trade, and a triumph of science equal to any of the present day. The steam jet is now used to ventilate the mine; the galleries are perfectly clear, and the men are working with naked candles. In all the progressive stages of coal mining, but more particularly of the present time, when we find that by the ingenuity of scientific developments it has become one of the most prodigal sources of wealth, not only to the capitalist, but to the labouring artizan, the uncertain value of mineral property has invariably thwarted and repulsed the enterprise of the nation. To-day we may have a remunerative adventure, watched over by the genius of revealed theory and practice, while to-morrow may discover it has become the element of wholesale destruction to life, or a wreck of private hazard and national wealth. This experiment goes far to remove the impending danger, and render those difficulties which hitherto have been insuperable, easy to be overcome, and at so trifling a cost as to be within the reach of the smallest capitalist. The simplicity of the experiment is only exceeded by its novelty; and the success is unquestionably the most perfect that any single demonstration could possibly have produced. The advantages are more numerous than we can here detail. Supposing an ordinary fire requires the shafts to be sealed for two months, what is the proprietor to do in the mean time if he cannot reduce the fire to a given space in the mine? His connections in trade, if not entirely lost, are restricted and broken; his mine injured and consumed, and the working colliers left to starve out the interim. His annual rents, interest of capital, and the more serious disbursements of incidental expenses, fall heavily upon him; whereas the immediate application of our experiment would put the mine in a working condition with a delay of not more than two days. These facts are brought before the public for the benefit of all classes, being a public remedy for a national loss. To the untiring energy of Mr. Gurney are we indebted for them. He voluntarily tendered his services, and, owing to his ability, the mineral property of this kingdom has been insured against the destructive element of fire, and consequently made a safer investment for capital. I may add, the expense of this experiment was trifling compared to the inconvenience, delay, and cost of letting in water to fill the mine and pump it out again, being not more than as many pence as the other would have been pounds."

THE BENZOLE LIGHT.—CLAIM OF PRIOR DISCOVERY.

Sir,—I have great disinclination to controversy; but certain remarks of John Mac Gregor, Esq., in your last Number having removed all scruple, I request the obligation of space for the following remarks:—

In the year 1828, Mr. Porter, since of the Board of Trade, and myself obtained a patent for a mode of applying heat (see "Hebert's Register of Arts and Journal of Patent Inventions," new series, vol. ii. 267, as also my patent for improvements in distillation, described in *Newton's Journal*, 1836-7, vol. ix., page 156, conjoined series;) my surprise was therefore great when in your Number for the 10th June, 1848, I found Mr. Mansfield expatiating so eloquently upon this same invention as his own "Isothermal Still Oven!"

Mr. Mansfield, in his paper read before the Institution of Civil Engineers, 17th April, 1849, objected to my light, and insinuated that it was as I left it—a failure, and that he had made improvements thereon. This I deny; he stated that the difficulty has now been solved by the discovery of a liquid hydrocarbon called "benzole." Why, Mr. Editor, benzole was first discovered by Faraday, among the products of destructive distillation of organic matter, long before my first patent for light,—was, in fact, the *first hydrocarbon that I used with atmospheric air to form a vapour light*, with a common argand gas-burner with enlarged holes. If any of your numerous readers will consult vol. vii. of *Newton's Journal*, 1835-6, conjoined series, page 299, for my first, and the *Mechanics' Magazine*, No. 825, for my second patent for air light, they will see that in every particular Mr. Mansfield has been anticipated; that gentleman is, in fact, infringing my second patent, it not having yet expired. If you, Mr. Editor, who in your Nos. 812 and 813 honoured me by your remarks, should think it necessary to refresh your memory, I should be proud to show you one of my patent lamps, with a most brilliant light, burning a much heavier and cheaper fluid than benzole, without trouble or attendance, until the reservoir is empty.

The *field* of Mr. Mansfield has, therefore, been explored, and its beauties shown in a *strong light* before he entered upon its precincts, and, basking too exclusively in the sunshine, forced me to leave the penumbra into which I was thereby cast.

I am, Sir, yours, &c.,

J. T. BEALE.

East Greenwich, June 27, 1849.

MR. DERING'S MODE OF GIVING UNIFORMITY OF ACTION TO ELECTRIC CLOCKS AND TELEGRAPHS.

Sir,—Your correspondent, George E. Dering, has contrived a very ingenious method of "giving uniformity of action to electric clocks and telegraphs." Its only fault is that a pendulum or any other machine, constructed on such a principle, *would not go*.

If any force or power be divided into two equal parts, and one part act in opposition to the other, one will *neutralise* the other, not *equalise* the motion. To use your correspondent's own illustration, "If an exactly equal weight (say of 1 lb.) were added to each end of a lever, *equilibrium* must result, not motion. One of the coils in the new arrangement must preponderate in power before the clock would continue in motion; and it is evident if this were the case, the same objection would apply as in the old arrangement, for the electric energy being distributed over the whole of the coil, an increase of battery power would produce an increase of moving power in the same ratio as before. I am, Sir, yours, &c.,

W. HISLOP.

Islington.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 28TH OF JUNE.

PIERRE ARMAND LECOMTE FONTAINEMOREAU, South-street, Finsbury, London, *for certain hygienic apparatus, and processes for preventing and curing chronical and other affections, and to prevent and stop certain epidemic diseases.* (Being a communication.) Patent dated December 21, 1848.

The principal features of this invention are, 1. The application of cold or dry heat, or water to any diseased portion of the human frame without allowing actual contact to take place, which is accomplished by fitting to the affected part a bag made into the requisite shape, and composed of a suitable elastic and impermeable material, into which the air or water is pumped. Or, in the case of congestion of the brain, an elastic cap, provided with an inflow and an outflow tube is made to fit tightly around the top part of the head and water pumped into it. 2. The employment of metallic spring mattresses, which are raised to any required temperature and made to impart a portion of the heat to the patient.

The details of this invention are unfit for publication.

Claims.—The mode of treating diseased or affected persons by the application of cold, of dry heat, or water without humidity.

2. The employment of garments composed of some impermeable material, and cut into the desired shape for applying cold, or dry heat, or water, for the same purpose.

3. The apparatus made in the shape of a sofa, bed, or couch, to afford repose, relief and heat to diseased persons.

JOHN TRAVIS, and JOHN M. INNES, Liverpool, lard refiners, *for improvements in packing lard.* Patent dated December 21, 1848.

These improvements consist in substituting for the bladders hitherto employed to contain lard, bags of cotton or muslin, saturated with a cement composed of animal gelatine and farina, or starch paste.

Claim.—The application of a suitable woven fabric, such as the one described when made into bags for containing lard.

WILLIAM RIDDLE, Whitefriars-street, London, gentleman, *for improvements in the construction of ever-pointed pencils, writing and drawing instruments, and in inkstands or inkholders.* Patent dated December 21, 1848.

The improvement in "pencils" consists in placing inside the case an eccentric curved volute. A portion of the case is cast off longitudinally from the rest, to form the reserve. The leads are placed in the case and the volute caused to revolve, which has the effect of bringing the fresh lead over the hole of the point and under the propelling wire. When this lead is exhausted the propelling wire is thrust backwards, and the volute turned further round, so as to bring the next lead into position. Or, a slate pencil, or other marking substance is placed in the longitudinal groove of a stem which has a spiral groove cut on its periphery, and extending from end to end. A collar, with a catch fitting into the longitudinal groove and pressing against the top of the pencil, is made to encircle the stem, and a spring is coiled into the spiral groove around the stem and made fast at bottom, while it is attached at top to the collar.

The improvements in "writing and drawing instruments" have for object, *firstly*, to render gold pens softer or harder at pleasure, which is effected by the pressure on the back of the pen of the point of a spring attached to a collar capable of being screwed up or down the handle—the softness or hardness depending upon the distance of the point of pressure from the nib. And, *secondly*, in enabling the pen to retain more ink than usual by adapting to the under-part of it an arm-piece, which may be curved, or hollowed out, so as to form a cavity with the pen in which the ink will be held.

The improvements in "inkholders" consist in silvering them on the inside and varnishing it to prevent any injurious action thereon, and in attaching a spiral spring to the bottom of the holder and the cover, which, when the cover is shut down inclines at an acute angle on one side of a perpendicular line, and thereby keeps it closed, and which, when the cover is lifted up, inclines at an acute angle on the other side of the perpendicular, and thereby keeps it open.

No claims are made in this specification.

WILLIAM CURTAIN, Retreat-place, Homerton, gentleman. *For certain improvements in the method of manufacturing Brussels tapestry, Turkey and velvet or pile-cut carpets and velvets, silks, linen, mixed cloths and rugs of all descriptions, by which method less warp is required, and perfect and regular figures or patterns are produced.* Patent dated December 21, 1848.

The worsted warp is first woven into a slight cloth, with four or six shoots to the inch, sufficient to hold the threads tightly together; the cloth roller is then removed to the printing machine, and the cloth led by elastic bands over the printing table and to another roller. Above the table is a traversing frame, in which the print is held by springs. The print is composed of a number of blocks, those intended to impress the colour being caused to project beyond the level of the others and held securely in position by iron cross rods; the frame is moved over the colour sieve, and the print forced down, so that the printing blocks may take up a sufficient quantity of colour, after which, the frame is moved back over the warp upon the printing table and the print forced down, whereby the coloured pattern is transferred to the warp. The warp is moved a sufficient distance forward, and the operation repeated on the next succeeding portion. When the printing is completed, the warp is removed to the warp beam of a loom and the ends undone, and the shoots removed. These ends are drawn one by one through a reed, the dents of which are fitted with a cutting edge on the outside; then through the harness; afterwards in any required number through a second reed, and thence to the beam, and so, that as the weaving operation proceeds the cutting edges of the first reed will divide the warp into its separate threads.

The patentee describes next a mode of producing terry surfaces of different patterns on both sides, by employing two warps differently printed, and alternately lifting and lowering a portion of the ground threads and one or other of the warps. The wires for producing the ribs are sharpened at one point, so as to cut the pile in drawing out. In silken fabrics when the shoot is used to produce

the figure, he proposes to spread the skein or shoot out, and to print it in various colours.

Claim.—Weaving the threads or warps into a slight cloth; printing the cloth so woven; printing the skein or shoot to be used in weaving silken fabrics, and the mode of weaving up the warp.

William Baker, Edgbaston, near Birmingham, C.E., and John Ramsbottom, Longsight, near Manchester, engineer. *For improvements in the construction of railway wheels, and in railway turn-tables, which latter improvements are applicable to certain shafts or axles driven by steam or other motive power.* Patent dated Dec. 21, 1848.

The railway wheel is constructed with spokes of angle iron which are bent into triangles, and arranged in two concentric circles with the bases outwards, and the ends which form the apices placed together. The boss is cast on these ends, and the bases clamped together. The tyre, which is made on the inner circumference with a shallow dovetail groove, is then shrunk on to these bases, so as to draw each pair of spokes together, and the tyre is held on by means of pieces of metal which are driven into the spaces between each pair of spokes, and there held fast by riveting or upsetting.

The turn-table consists of top and bottom plates, which are suitably supported on a central shaft, and constructed with a number of concentric and corresponding grooves in their inner and opposite faces. Spheres, cones, or cylinders, are then placed in the grooves of the lower plate, and serve as bearings to the top plate of the turn-table. The number of spheres, cones, or cylinders, in these grooves, diminish from the outer to the inner one in a greater proportion than would be due to the differences of their diameters. The edges of the table are provided with a rim to shield the interior from ballast, and to support the ends of the rails of the permanent way. The bottom plate is perforated with numerous holes, some to receive the spikes for bolting it to the sleepers, and the rest to drain off the surface water.

The patentees describe several modifications of the turn-table, such as forming the bottom plate of concentric grooved rings bolted to the sleepers or suitable foundation, and constructing the rings in pieces and bolting them together; also making the top plate in segments of a circle, and riveting them together. Sometimes the grooves are made large enough to hold two rows of spheres.

Lastly, this invention consists in the application of the preceding principle of construction to support shafts or axles; that is to say, shafts subject to great strain in the direction of their length. They are cast with shoulders, fitted on the face, with concentric grooves; opposite to the shoulders are fixed collars of hard metal, having on the face in front of the shoulders a like number of corresponding concentric grooves. A number of spheres, cones, or cylinders, are placed in the spaces formed by the grooves in the shoulders and the collars, and serve to relieve the shaft from a considerable portion of the strain. Or, if the shaft is vertical, the bearing end, and supporting heel-piece are furnished with a number of corresponding concentric grooves, and into the spaces so formed are placed the spheres, &c., as in the preceding case. The grooves of the heel-piece are filled with some lubricating mixture to decrease the friction.

Claim.—The improved construction of railway wheels, and the arrangement and combination of cones, cylinders, or spheres, in the manner and for the purposes before described.

James Henry Staple Wildsmith, City-road, London, experimental chemist. *For improvements in the purification of naphtha (called wood spirit and hydrated oxide methyle), pyroligneous acid, and eupion, and certain other products of the destructive distillation of wood, peat, and certain other vegetable matters, and of acetate of lime and shale, and in the purification of coal tar and mineral naphtha, likewise spirit being the products of fermentation.* Patent dated December 21, 1848.

This invention consists in employing permanganate of potash, bichromate of potash, chromate of potash, or other similar substance which possesses the property of giving its oxygen, or a portion thereof, to combine with carbo-hydrogen or the odour-giving element of any of the matters enumerated in the title.

The purifying material may either be employed in the shape of salt or acid, and the proportion of the materials one to the other, and length of time the operation is to be allowed to work, depend upon the natures of the purifying and to-be-purified substances. The combination is effected in a tank, a portion of which is cut away and glazed to allow of the penetration of light, and of its consequent action upon the liquid contained therein. The mixture remains in the tank from 14 to 21 days, and is each day stirred once or twice. To facilitate the operation, sulphuric or hydrochloric acid is added.

Although the patentee does not confine himself to any exact proportions, stating that they must be ascertained by actual experience he gives the following as the results of his experiments.

To 1 gallon, imperial measure, of naphtha, &c., 4ozs. of permanganate or bichromate of potash.

To 1 gallon, imperial measure, of eupion, 3ozs. of permanganate or bichromate of potash.

To 1 gallon, imperial measure, of spirit being the product of fermentation, 2ozs. of permanganate or bichromate of potash.

When the chromate of potash is employed in any one of the preceding cases, the proportion is to be doubled.

Claims.—1. The application of substances capable of yielding their oxygen in the reduction or combination of the carbo-hydrogen or odour-giving subtances.

2. The spontaneous action of light as essential to the success of the operation.

3. The use of permeable vessels for this purpose.

THOMAS DICKINS, Middleton, Lancaster, silk manufacturer. *For certain improvements in machinery or apparatus for warping and beaming yarns or threads composed of silk or other fibrous materials.* Patent dated December 21, 1848.

This invention has for its object to preserve a more equal tension and strength throughout the whole of the warp, to facilitate the taking the lease or cast, and to prevent the threads so often breaking and becoming entangled.

For these purposes the bobbins are supported in a creel opposite to the frame, which carries a pair of glass rollers and the "lease reed," and behind this frame is the mill. The threads are led between the pair of rollers, and each alternate one between the dents of the "lease reed," while the intermediate ones are drawn through the slots cut for that purpose in the dents. The ends of the threads are knotted and made fast to a peg on the drum, and the reed is drawn up so as to form a shed, into which a slip of wood is introduced. The shed reed is then lowered, and a second shed formed, into which a second slip of wood is introduced, and the threads slipped over two pegs fixed on the drum, which is then made to revolve, and at the same time to traverse horizontally, by having its axle hollow, and provided with a female screw which works on a screwed shaft driven by steam or manual power. When a fresh supply of yarn is wanted, it is worked in the same way, and knotted and attached to pegs on the side of the drum, opposite to where the first pegs were placed. When a sufficient quantity of yarn has been wound upon the drum to form the warp, the different strands are led thence under a roller, and between guides, to the beam roller, on which they are wound.

Claims.—1. With respect to the warping apparatus, the general novel construction and arrangement of apparatus, the peculiar formation and application of the lease reed, and causing the mill, when in a horizontal position, to move in a traversing direction, or the lease reed creel, and guide rods to traverse in a lateral direction.

2. As regards the weaving apparatus, the general arrangement and construction whereby the yarn is wound on the beam direct from the mill without being first moved upon a drum, or supplied in the form of a ball.

WILLIAM WILKINSON, Dudley, Worcester, manufacturer. *For a certain improvement or certain improvements in the construction of vices.* Patent dated December 21, 1848.

In Mr. Wilkinson's improved vices, the moveable arm, instead of being directly united to the immoveable one, is jointed by a pin to one end of a short horizontal rod, which forms part of the fixed arm, so that the moveable cheek in opening travels in a direction more nearly approaching a horizontal line than in ordinary vices, and is consequently capable of being opened to a greater extent. The screw is made to work inside a collar screwed interiorly, which is held fast in one of the cheeks, whereby the filings will be prevented from falling on the screw. Or, the screw vice boxes may be cast in brass, and fitted loosely into position. The two arms, with their cheeks, and the horizontal bar, are forged in two parts by means of a die and tilt hammer, worked by steam, instead of being forged in several pieces by hand hammers, as has hitherto been usual.

To bore the cheeks for the reception of the collar, and to turn the female screw, the patentee purposes to employ a sliding table, and a vertical shaft which is fitted with a drill. The table supports the cheeks underneath the drill, and slides upwards in guides as they are bored out. When the female screw is to be turned, the drill is removed, and a tool, having a certain number of lateral projections placed equidistantly apart, is substituted in its stead.

Claims.—The method of forming the joints of vices on cheeks connected to the standing arms, whereby the moveable arms are caused to move in a line more nearly approaching to a horizontal one than in ordinary vices, whether in conjunction with loose or fixed vice boxes.

2. The mode of constructing brass vice boxes.

3. The forming the arms, cheeks, and bolts of vices by means of dies and tilt hammers.

4. The method of drilling the interior screw in vice boxes.

CHARLES AUGUSTUS HOLM, of King William-street, civil engineer. *For improvements in printing.* Patent dated June 21, 1849.

These improvements consist—

1. In the application of revolving surfaces

for distributing the ink, in combination with various other movements, to flat-surface printing presses.

2. The employment of machinery for shading or printing paper, silk, and other fabrics with one or more colours. The blocks are inked perpendicularly, and the machinery is so arranged that the blocks remain stationary while the tearer supplies the colour; and the tearer, when it arrives on their under surface, remains stationary while the blocks travel, and cause the fabric to advance, so that the fabric may receive several impressions to produce greater intensity of colour, or, as they are termed, rainbow patterns. The patentee employs also a vacuum table in combination with this machinery, by which the colours are drawn through the fabric by the influence of the atmospheric pressure, and the pattern so produced in both sides. In block printing, when the fabric has to be moved onwards, air must, of course, be admitted into the table to destroy the unbalanced pressure.

3. The use of certain combinations of machinery in printing fabrics, for subjecting the same parts to repeated impressions by means of surface or printing rollers geared together by intermediate wheels or by a chain, so as to preserve the registry of the pattern.

[We do not give the claims in this case, because they are not less than 25 in number, cover nearly two sheets of closely written parchment, and contain such constant reference to the drawings, that without engravings of the drawings themselves, no reader could comprehend the scope of the claims. What, for instance, could be learnt from the mere words of such a claim as this:—"I claim the peculiar arrangement exhibited in fig. 12, and before described?"—Ed. M. M.]

NOTES AND NOTICES.

A One-Wheeled Carriage—The Horses Inside.—A new and very novel invention, called a one-wheeled coach, has recently been tried, out West, and promises to be of much value, especially on prairies, or wherever the surface of the ground is tolerably level. The vehicle consists of a large hollow wooden wheel, 14 feet in diameter, and 6 feet wide. The horses are placed inside, and propel it along in the same manner that a caged squirrel makes its wheel revolve. Slabs are nailed on the inside floor of the wheel, by which the horses obtain foot-hold. In the centre is a small iron shaft, from which suspend hangers, which support four comfortable sofas for passengers; the wheel thus revolves freely, the seats remain in perfect equilibrium. The arrangement for guiding the carriage is very simple and effective; it can make a much shorter turn than a stage coach. A very successful trial of one of these carriages was recently made on the State Road, between Canal Dover and Tuscarawas county, Ohio, which perfectly demonstrated their utility in transporting very heavy loads with ease and rapidity. The carriage was filled by a party of 24 ladies and gentlemen, with two heavy draft horses previously trained to propel them. The distance between the two places, five miles, was performed in twenty-eight minutes on the first trip, and twenty-five minutes on the second. The horses are not confined by harness, and, as they travel, as it were, on an endless plank road, their work is comparatively easy.—*Boston Chronotype.*

Distillation of Sea Water.—(*Portsmouth, June 17.*) During the present month three of Her Majesty's ships—the *Arrogant*, 46, Captain Fitzroy; the *Plumper*, 11, Commander Nolloth; and the *Reynard*, 11, Commander Cracroft—have sailed from this port, furnished with the Government distilling and cooking galley, constructed by Mr. Grant; other galleys of the same kind are also in course of manufacture for the largest class of vessels. The *Dauntless*, 1,496 tons; the *Termagant*, 1,556 tons: and the *Encounter*, 966 tons—all new ships, on the screw principle—are ordered to have first-class machines of the above description. By the improvements made since the introduction of the galleys into the naval service the quantity of fresh water obtained by the distillation of salt water during the period it is required to keep the fires alight in the galley for the purposes of cooking will, on the average, supply each individual on board the vessels with one gallon of distilled water every day! The latter kind of water continues to be preferred for drinking and culinary purposes to the water usually supplied to ships; it passes immediately from the condenser into the water tanks at the same temperature as the surrounding ocean. In these tanks it becomes perfectly aerated, losing altogether the vapid flavour common to all distilled water in the course of a few hours, without the aid of chemical preparation or mechanical arrangement, by the simple fact of the action imparted to the fluid by the motion of the ship when at sea. A series of very interesting and important experiments have, however, been made, and are still in progress, on board the *Illustrious*, 72, Captain Yates, bearing the flag of Rear-Admiral Prescot, C.B., in this harbour, by Mr. Crosse, with the view of imparting at the moment of distillation the oxygen of which the water is deprived in the process, and giving to it that briskness which is found in spring water. This is effected by passing a proportionate current of electricity through the particles of water by means of an extremely simple and self-acting apparatus. The results of the experiments made have been highly satisfactory. The only point to be determined is, whether any artificial means, either chemical or mechanical, are required for aerating distilled water on board ship, as it is found that such water becomes sufficiently aerated in the course of a few hours by the motion imparted to it by the ship; but if the distilled water is required for immediate use, Mr. Crosse's application produces the object desired most effectually.—*Times.*

WEEKLY LIST OF NEW ENGLISH PATENTS.

Henry Bessemer, of Baxter House, St. Pancras, Middlesex, engineer, for improvements in the methods, means, and machinery or apparatus employed for raising and forcing water and other fluids. June 23; six months.

Thomas Merchant, of Derby, civil engineer, and Robert Harland, of Derby, carriage builder, for certain improvements in the construction of railway carriages. June 25; six months.

George Benjamin Thorneycroft, of Wolverhampton, iron master, for improvements in manufacturing railway tyres, axles, and other iron where great strength and durability is required. June 26; six months.

Thomas Wood Gray, of Limehouse, brass-founder, for improvements in water closets, pumps, cocks, lubricators, and deck lights. June 26; six months.

James Nasmyth, of Patricroft, near Manchester, engineer, for certain improvements in the method of and apparatus for communicating and regulating the power for driving or working machines employed in manufacturing, dyeing, printing, and finishing textile fabrics. June 26; six months.

James Leadbetter, of Kirby Lonsdale, Westmore-